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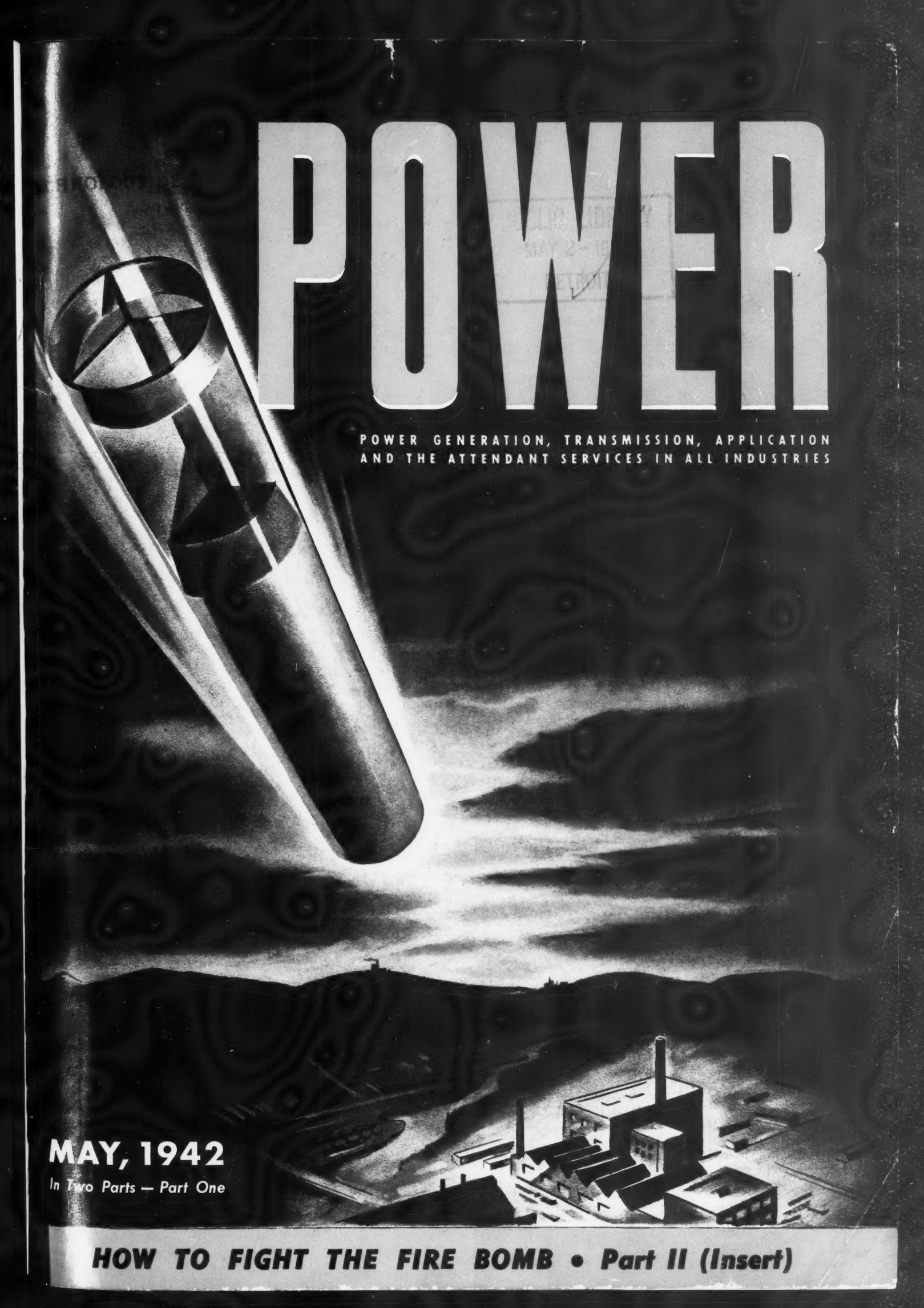
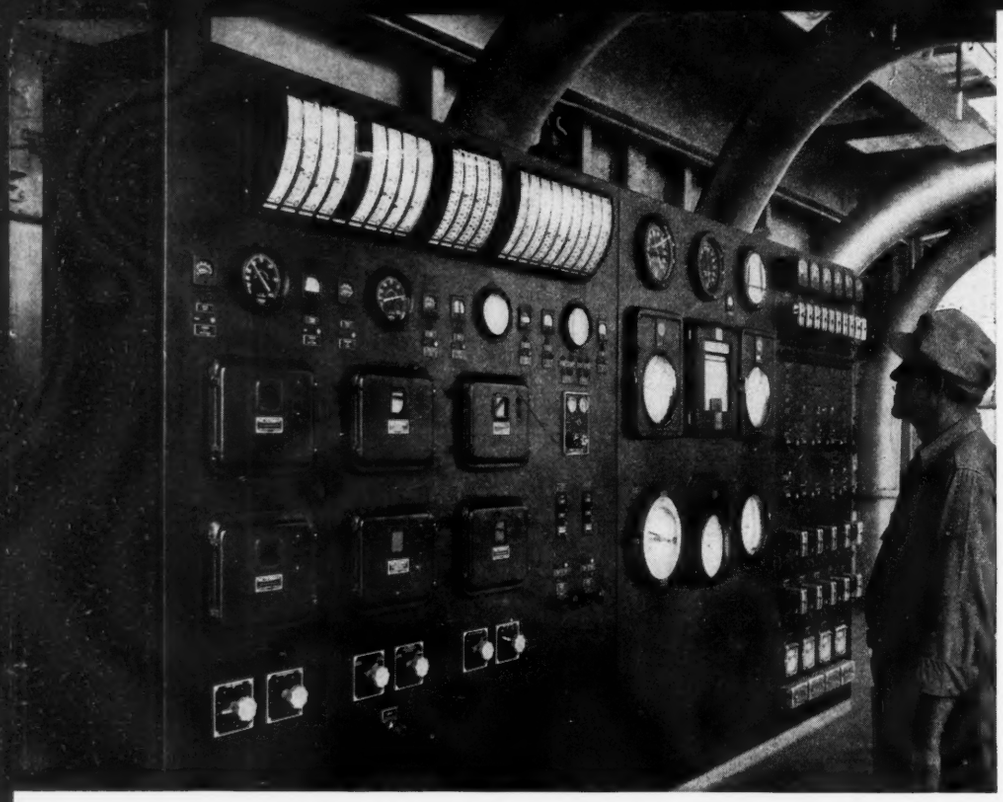
POWER GENERATION, TRANSMISSION, APPLICATION
AND THE ATTENDANT SERVICES IN ALL INDUSTRIES



MAY, 1942

In Two Parts — Part One

HOW TO FIGHT THE FIRE BOMB • Part II (Insert)



Metermax Combustion Controllers in Use

Micromax Flowmeter Recorder Showing Flow to Turbine

If Your Load Has A Wartime Swing, Here's How L&N Can Help You

In the boiler and turbine rooms are a whole group of operating problems which we can possibly help you handle. If some of your men are in uniform, or your power load has a wartime swing, perhaps the following are needed:

Control of Combustion. Metermax instruments handle any problem, whether simple or complex, for any plant from a few hundred horsepower to the biggest private or public-utility plant. Particularly, you'll like micro-responsiveness, dependability, and set-it-and-forget-it qualities. See Catalog N-01-163.

Temperature Records. 24-hour strip-charts which fit a letter file, and record in as many as 6 colors, are available from Micromax Temperature Recorders. See Catalog N-33-163 for steam-end uses, and N-33-161 for electric ones.

Control of Superheat. If you're installing a new boiler, here's a comparatively new Micromax Control which saves a lot of power. Details in Catalog N-33-163(1), sent on request.

Record of CO_2. A Micromax CO_2 Recorder is as dependable as a pyrometer, and almost as simple. Characteristics are sensitivity and *quick* response; explained in Catalog N-91-163.

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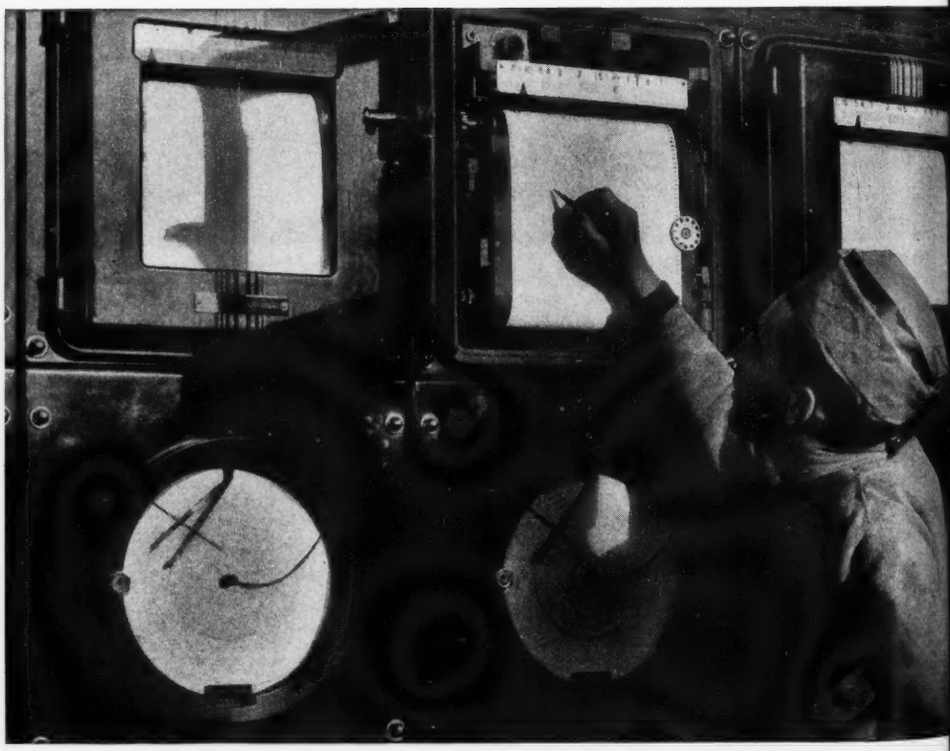
Satisfactory Boiler-Feed Water. Automatic records of the conductivity of condensate, or of the pH of feedwater, or of both, are available through Micromax equipments. Catalogs on request.



Micromax Conductivity Recorders in a Cotton Mill Power Plant

Jrl Ad N-163(8)

LEEDS & NORTHRUP COMPANY, 4910 STENTON AVE., PHILA., PA.

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MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

POWER (with which are consolidated "Science and Industry," "The Engineer Review," "The Engineer," and "The Stationary Engineer"), May, 1942, Vol. 86, No. 5. Published monthly with an additional Directory number in December. McGraw-Hill Publishing Company, Inc. Publication office, 99-129 North Broadway, Albany, N. Y. Editorial and Executive offices, 330 West 42nd Street, New York, N. Y. Entered as second class matter August 25, 1936, at Post Office, at Albany, N. Y., under the act of March 3, 1879. Printed in U. S. A. Allow at least ten days for change of address. All communications about subscriptions should be addressed to the Director of Circulation, 330 West 42nd Street, New York, N. Y. Subscription rates—U. S. and U. S. Possessions, $3.00 for one year, $4.00 for two years, $5.00 for three years. Canada, $3.50 for one year, $5.00 for two years, $6.00 for three years. Great Britain and British Possessions 36 shillings per year. All other countries $6.00 for one year, $9.00 for two years, $12.00 for three years. 35c per copy.

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the LINK-BELT way MEANS Efficiency AND LOW COST

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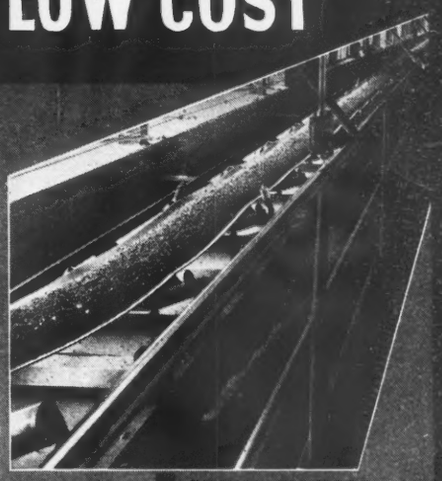

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• Getting coal to the fire and ashes away from it, presents one of today's most fertile sources of making economies and increasing efficiency in power plant operation. Link-Belt's nation-wide manufacturing facilities and engineering experience make for quick, expert cooperation with consulting and operating engineers in making economies in all sizes of plants. Send for book No. 1510, "Solving The Problem of Coal and Ashes Handling in the Boiler Plant."

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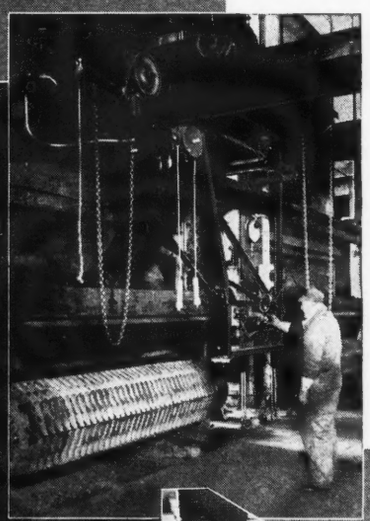

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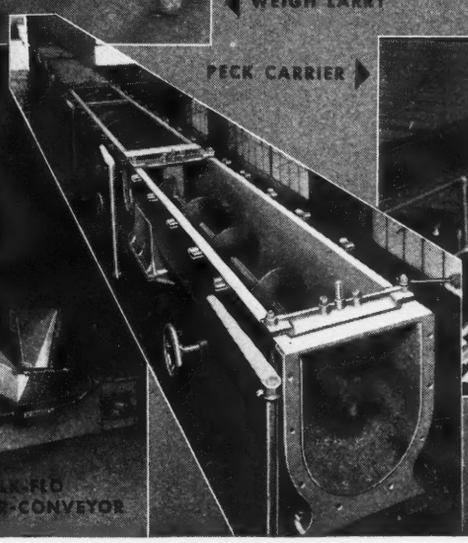
SKIP HOIST



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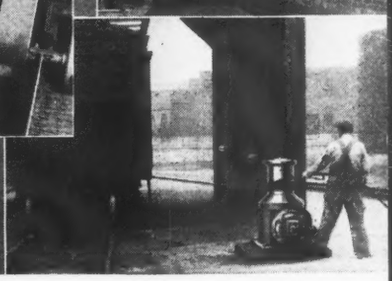

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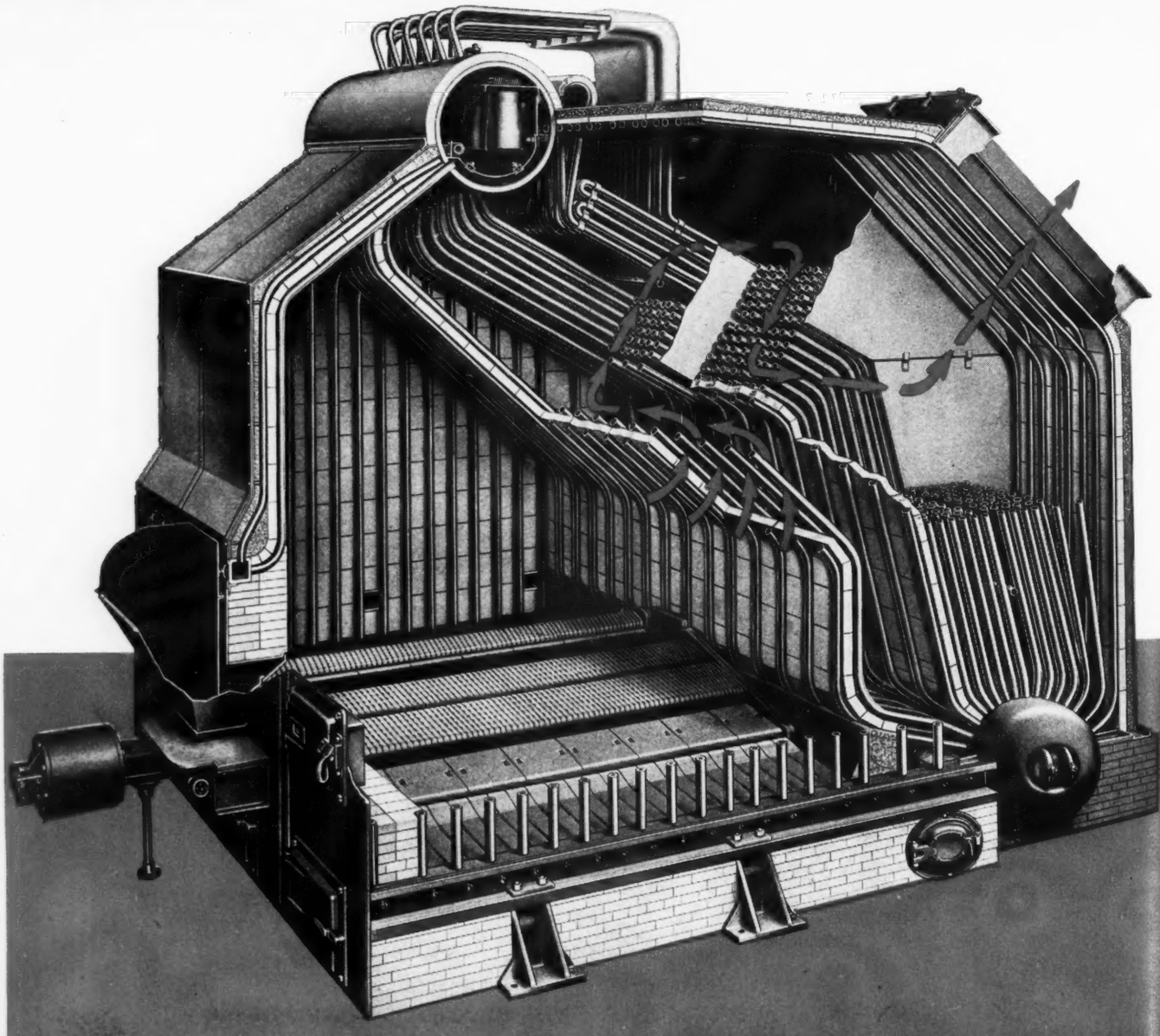
Economical STEAM PRODUCTION



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N FOR *Smaller* PLANTS ALSO

Many of the B&W principles upon which hundreds of the great utilities rely for the economical production of steam are now available also to plants of smaller capacity—as low as 9000 pounds of steam per hour—in the Babcock & Wilcox Integral-Furnace Boiler, Classes 9, 12 and 15.

One of these principles, used in central stations generating an aggregate of more than 18 million pounds of steam per hour is the furnace arrangement in which the primary combustion zone is followed by an open pass. With this design the gases are thoroughly mixed while at high temperatures, thereby aiding in efficient and smokeless combustion.

For many reasons besides that of efficient combustion, B&W Integral-Furnace Boilers are a logical choice for small, as well as larger plants—reasons such as simplicity of operation, and low maintenance. Bulletin G-34-A tells the story. Write for your copy.

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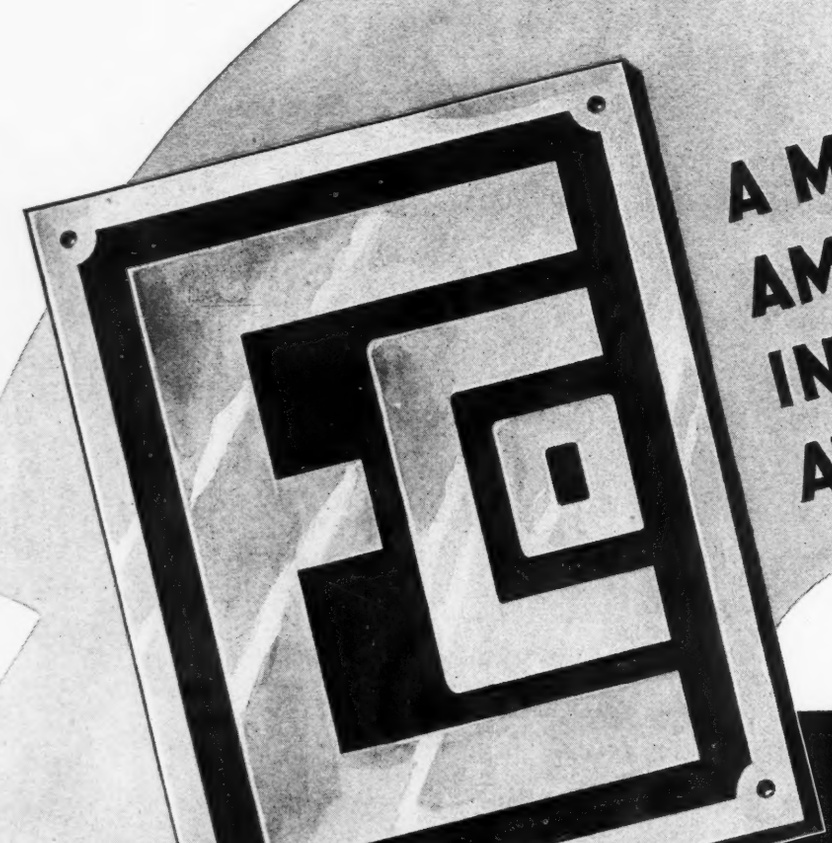
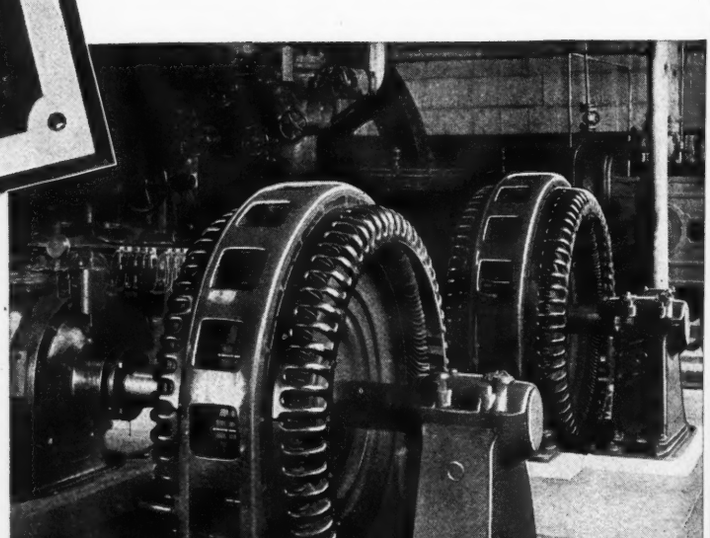
G-218 T

-FURNACE BOILER

One symbol like this is worth a



A MARK OF AMERICAN INDUSTRY AT ITS BEST



Two Elliott engine-type synchronous motors equipped with double diamond-cage winding, driving compressors. They are doing an excellent job and their operation is exceptionally quiet.

L-734

ELLIOTT COMPANY

Electric Power Dept.
RIDGWAY, PA.
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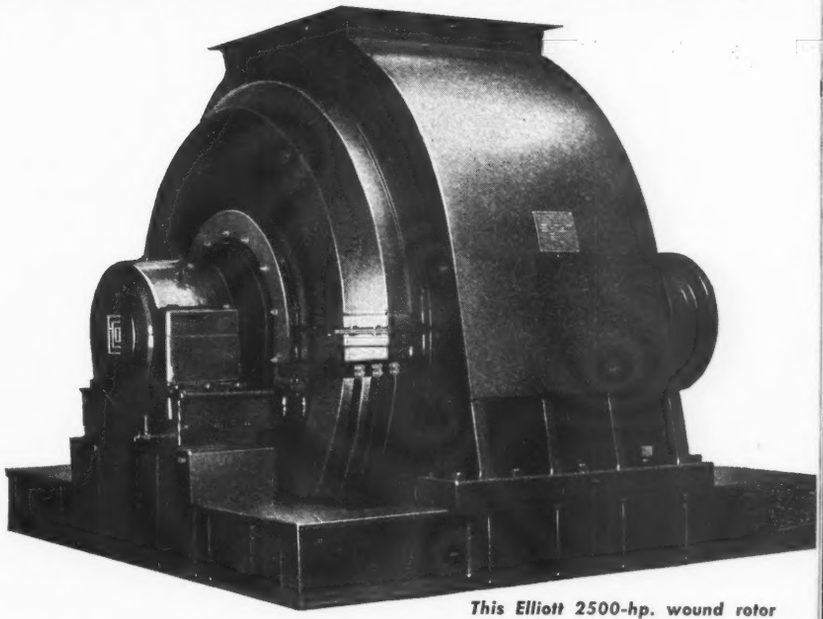
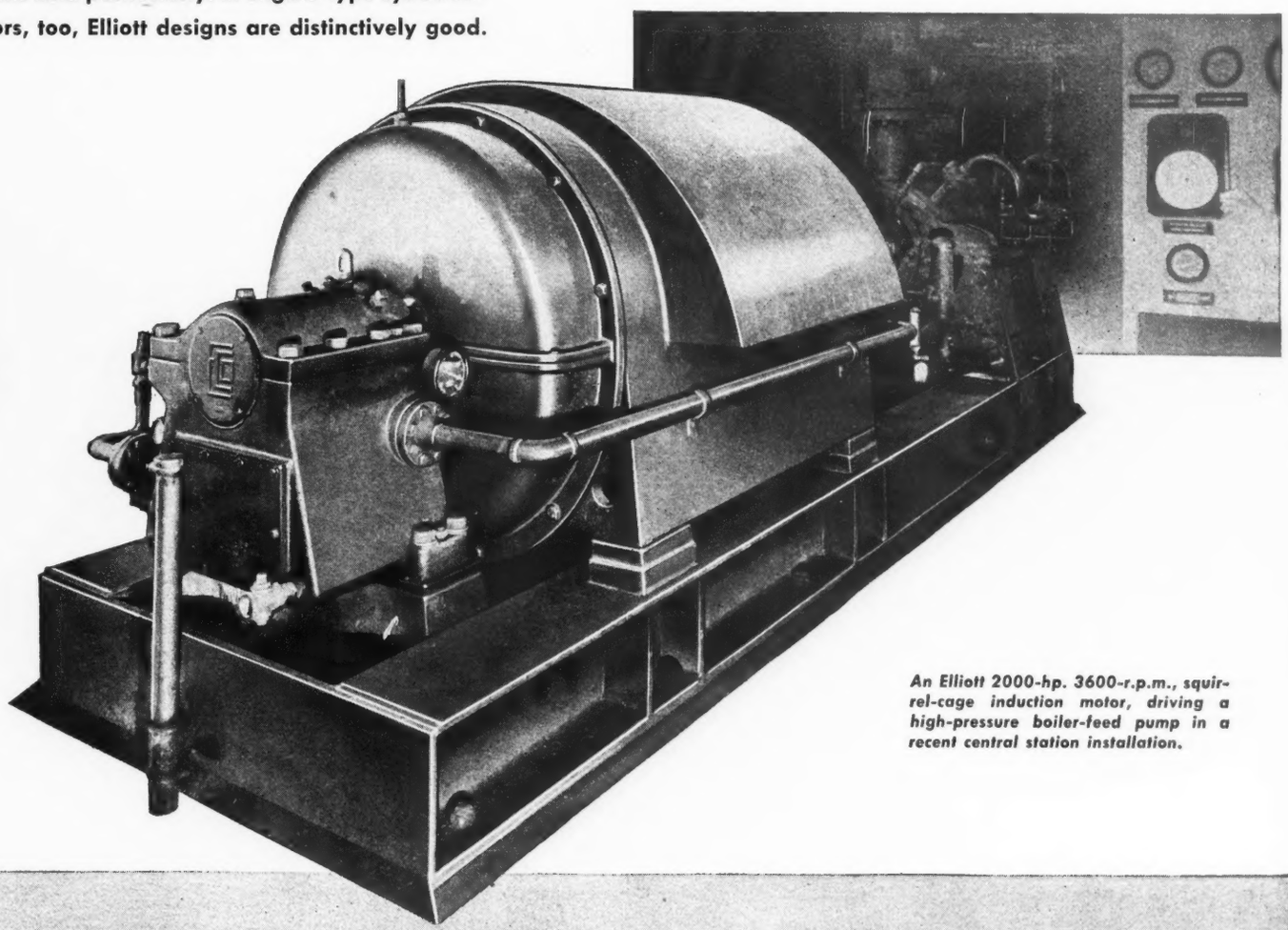
a million SWASTIKAS!

They started it, this war of identifying marks and monograms. But our enemies' rising suns and swastikas have now run head-on into the might of American Industry, as typified by the Elliott symbol and countless others which in their total represent invincible skill and productive capacity. Power will win the war — the power behind the trade-marks of America.

TAKE MOTORS, FOR INSTANCE — the Elliott mark is found on the bearing caps of thousands of capable, quiet driving units whose every revolution adds to anti-Axis force. For rugged, dependable Elliott motors are particularly fitted and widely applied where conditions are unusual or the driving job especially difficult. Important public utility and industrial plants come to Elliott Company for large two-pole high-speed motors for such service as driving high-pressure boiler-feed pumps. Elliott engineers have done outstanding work in this field particularly. In engine-type synchronous motors, too, Elliott designs are distinctively good.



This Elliott 2500-hp. wound rotor induction motor is one of a number of similar motors in service, driving dredge pumps, a notoriously difficult job.



An Elliott 2000-hp. 3600-r.p.m., squirrel-cage induction motor, driving a high-pressure boiler-feed pump in a recent central station installation.

TURBINE-GENERATORS • MECHANICAL DRIVE TURBINES • ENGINES • ENGINE-GENERATORS

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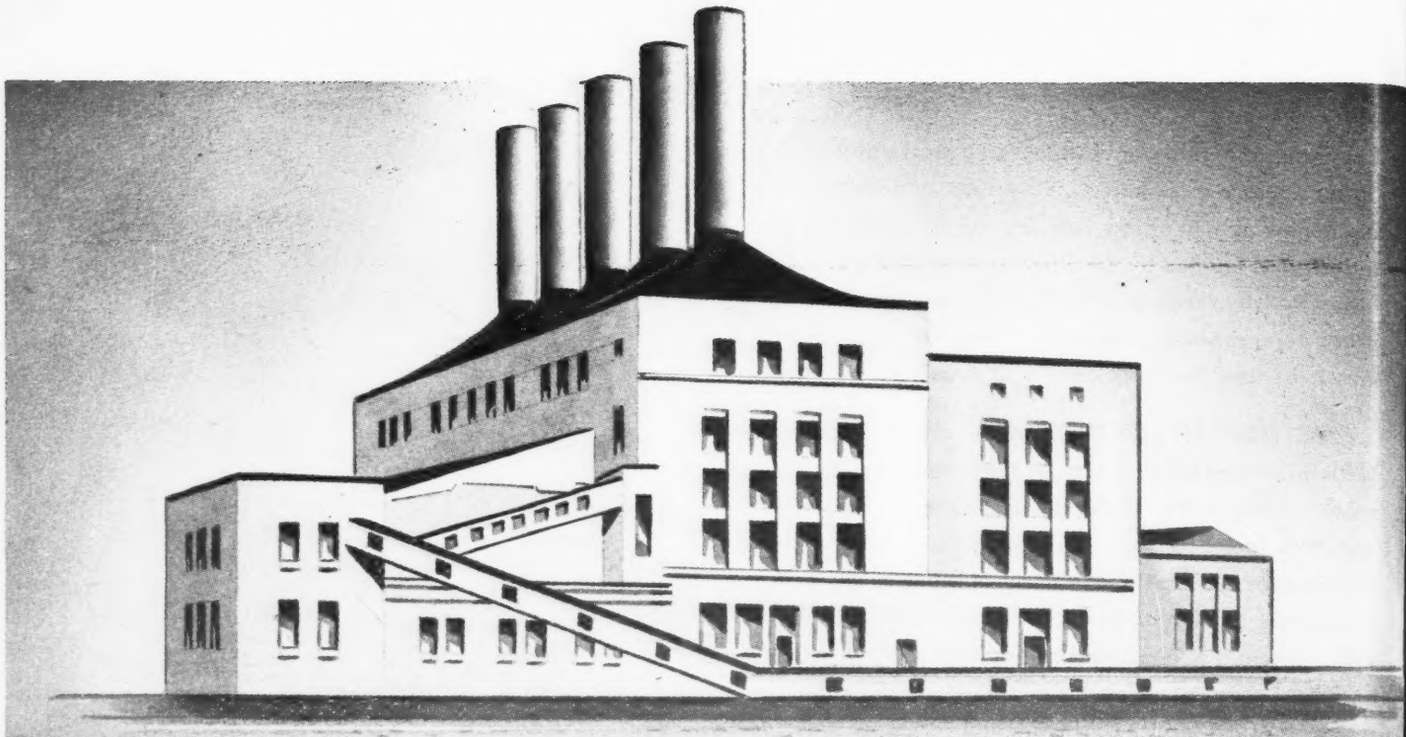

A FEW RECENT OUTSTANDING CENTRAL STATIONS EQUIPPED WITH DIAMOND SOOT BLOWERS

Public Service Electric & Gas Co. Jersey City, N. J.
Central New York Power Corp. Oswego, N. Y.
Cleveland Electric Illuminating Co. Cleveland, Ohio
Public Service of Northern Illinois, Joliet, Ill
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American Gas & Electri
Northern States Power C
Illinois-Iowa Power Co.

United Illuminating Co. New Haven, Conn.
Pacific Gas & Electric Co. Avon, Calif
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Public Service Electric
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va, W. Va.
Light Co. Harrisburg, Penna.
rida Power & Light Co. Dania, Fla.
Natrona Light & Power Co. Natrona, Pa.

Cent Ohio Light & Power Co. Bluffton, Ohio
ates Power Co. St. Cloud, Minn.
lorado Power Co. Pueblo, Colo.
r & Light Co. Dayton, Ohio
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o. Cape Girardeau, Mo.
Co. Iowa City, Ia.
pus Christi, Texas
Co. Des Moines, Ia.
s Street Railway Minneapolis, Minn.
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SAVE YOUR SCRAP METALS— THEY'LL HELP WIN THE WAR

Scarcity of chrome, nickel, aluminum, copper, steel, iron and other metals is a serious threat to war production.

SAVE YOUR SCRAP! Keep each metal and alloy separate. Get it to your scrap dealer as fast as it is collected.

If no scrap dealer is available, get in touch with the original supplier of the material, who will help you arrange for return and re-use of your scrap.

Diamond Power Specialty Corporation will gladly accept scrap from any of our equipment—will pay return freight charges—handle disposal and remit to you any returns above the freight charges.

LET'S GO!

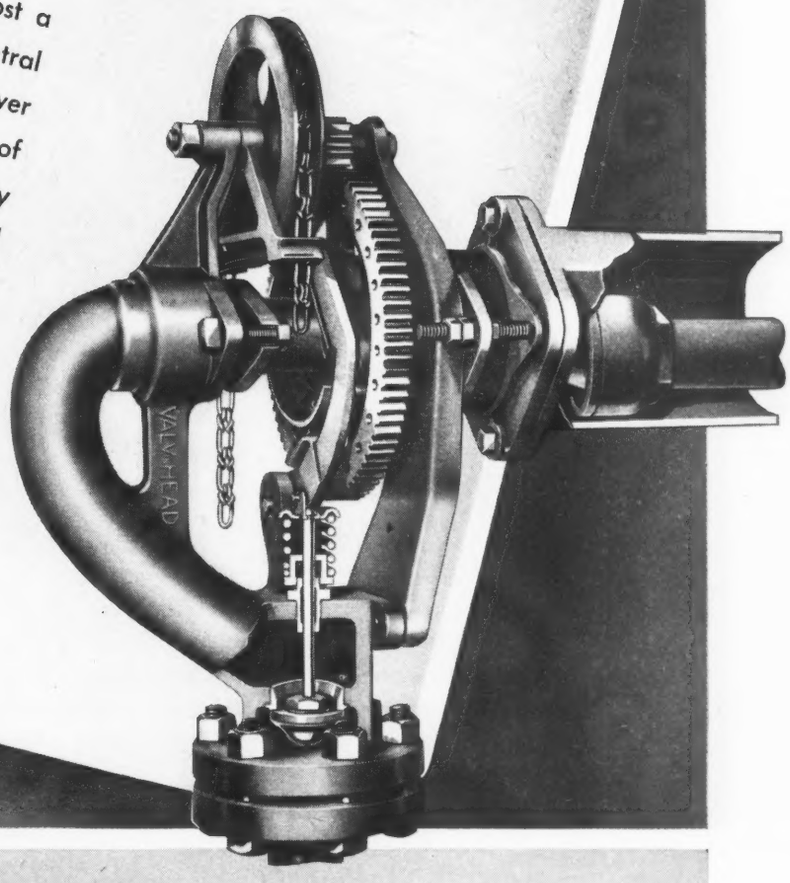
DIAMOND POWER

Where Soot Blowers Have to be Good

The Choice is Almost Invariably DIAMOND

Diamond Soot Blowers are almost a foregone conclusion in huge central station and industrial steam power plants. An overwhelming majority of engineers choose them because they know Diamond Blowers will stand the extreme severity of service—keep boilers cleaned of soot and slag and require little attention from the service man.

More than 80% of all the soot blowers on modern power boilers are Diamond.



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DIAMOND SPECIALTY LIMITED • WINDSOR, ONTARIO

● For posting on bulletin boards and shop walls in Linde customers' plants, a two-color version of the poster shown above is available. These posters will remind your employees of the vital need for fullest utilization of existing stocks of oxygen and acetylene cylinders and will thus help assure your gas supply. Ask any Linde office for the quantity you require, specifying Form 5104.

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Unit of Union Carbide and Carbon Corporation

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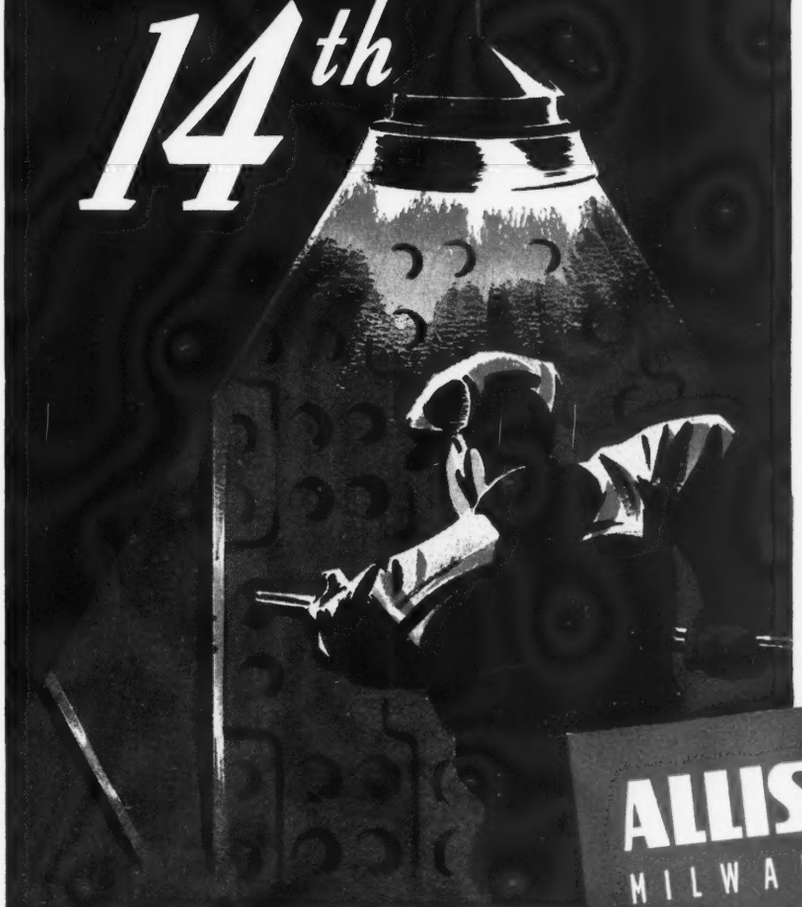
The words "Linde," "Prest-O-Lite," "Union," "Oxweld," "Purox," and "Prest-O-Weld" are trade-marks of Units of Union Carbide and Carbon Corporation.

The Night of MARCH 14th



THE WORST possible had happened.

The boiler in the power plant had failed, and Bill Stout, the power plant superintendent and his crew, were working wearily hour after hour to get that boiler in shape — repairing the damage that a good feedwater service would have avoided.

Down there in the boiler room on the night of March 14, Bill made a decision —

No more taking chances on hit and miss chemicals for treating *his* feedwater! He'd get the *best* feedwater service available!

And to Bill Stout, as to hundreds of other power plant men, the *best* is Allis-Chalmers Feedwater Service. For here's a service designed to protect power plant equipment *at all times* against scale, corrosion, carryover, and embrittlement. It's a service based on Allis-Chalmers' 60 years experience making power plant machinery. It's a service Allis-Chalmers has been offering to industry successfully for over 15 years.

If you want to eliminate the threat of unscheduled outages entirely from your plant, get the story of Allis-Chalmers Feedwater Service. Write for a copy of Bulletin B6133. A 1481

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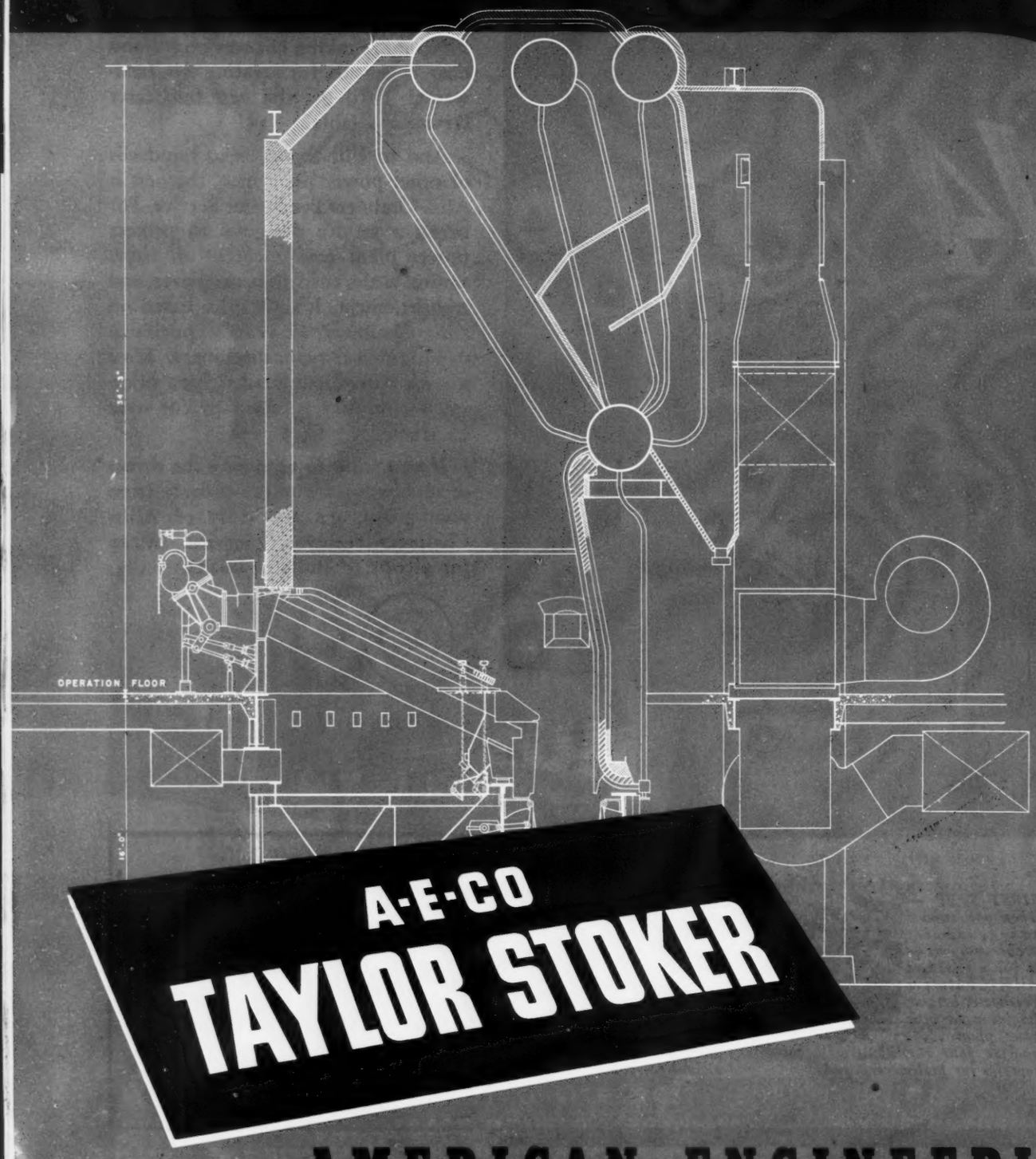
MILWAUKEE · WISCONSIN

FIRST STEP — when you submit your feedwater problems to us — is for a trained Allis-Chalmers Feedwater Service Engineer to visit your plant . . . analyze your conditions . . . take samples for preliminary study.

SAMPLES ARE then analyzed in the Allis-Chalmers laboratories . . . specific treatments suggested to prevent scale, corrosion, carryover, embrittlement, and all other feedwater ills, with provisions for changing conditions.

VITAL TO SUCcess of service — the Field Service Engineer in your territory makes frequent calls . . . inspects equipment . . . makes repeated water and steam tests . . . gives you complete feedwater protection at all times.

WITH LARGE STEAM USERS IT'S A-E-CO TAYLOR STOKERS



A-E-CO TAYLOR STOKER

AMERICAN ENGINEERING

A-E-CO TAYLOR STOKERS, WATER WALLS, ASH HOPPERS, HELE-SHAW FLUID POWER, LO-HED

TAKE A CASE IN THE PAPER INDUSTRY

PROBLEM: Several years ago a paper plant, large user of steam, needed more capacity and a wider range of steam generation. Their equipment, consisting of eight boilers fired by early model stokers, realized an efficiency of only 68 to 70%.

SOLUTION: A single high pressure boiler, with rated continuous capacity of 130,000 lbs. per hour, fired by a Taylor Air Cooled Stoker was installed. The unit was equipped with economizer, airheater and side and rear walls.

RESULTS: 1940-41 inclusive.

Total Steam Generated	1,746,970,000 lbs.
Total Coal Burned	170,139,000 lbs.
Average Actual Evaporation	10.26 lbs. S/lb. coal
Average Efficiency	84.1%
Preheated Air Temperature to Stoker	300-335°F.
Average Operating Conditions	
Steam Pressure	420 lbs. Ga.
Total Temperature	605°F.
Feed Temperature to Economizer	212°F.
Heating Value of Coal, as Fired	13,710 B.T.U.
Range of Steaming Capacity	25,000-145,000 lbs./hr.
Total Hours 1940-1941	17,544
Total Time Unit in Service	16,860
Availability Factor of Entire Unit	96.1%

A-E-CO TAYLOR STOKERS ON THE FIRING LINE

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*Aluminum Company of America, New Kensington, Pa.
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Chrysler Corporation, DeSoto Plant, Detroit, Mich.
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*DeLaval Steam Turbine Co., Trenton, N. J.
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Erwin Cotton Mills Co., West Durham, N. C.
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Hudepohl Brewing Co., Cincinnati, Ohio
Industrial Cotton Mills, Rock Hill, S. C.
*City Water & Light Plant, Jonesboro, Ark.
Kohler Company, Kohler, Wisc.
Maryland State Penal Farm, Roxbury, Md.
*Maybury Sanitarium, Northville, Michigan
Michigan Carton Company, Battle Creek, Michigan
*Michigan State College, East Lansing, Mich.
Municipal Light Plant, Marshfield, Wisc.
*Pacific Mills, Lyman, S. C.
*Packard Motor Car Co., Detroit, Michigan
*Municipal Electric Plant, Painesville, Ohio
*Park Drop Forge, Cleveland, Ohio
*Pennsylvania Electric Co., Seward, Penna.
*Pennsylvania R. R. Co., Philadelphia, Penna.
*Picatinny Arsenal, Dover, N. J.
*Pittsburgh Plate Glass Co., Barberton, Ohio
Borough of Quakertown, Quakertown, Penna.
Raleigh Wyoming Mining Co., Glen Rogers, W. Va.
*Rhinelander Paper Company, Rhinelander, Wisc.
City of Richland Center, Wisconsin
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Sayles Biltmore Bleachery, Biltmore, N. C.
Scooten Dillon Company, Detroit, Michigan
Shelby Cotton Mills, Shelby, N. C.
Sloane-Blabon Corp., Philadelphia, Penna.
Solvay Process Company, Detroit, Michigan
*St. Elizabeth's Hospital, Washington, D. C.
City of St. Bernard, Ohio
Swarthmore College, Swarthmore, Penna.
*Timken Roller Bearing Co., Canton, Ohio
Timken Roller Bearing Co., Gambrinus, Ohio
Municipal Water & Light Plant, Tippecanoe City, O.
City of Toledo, Ohio
*Union Bleachery, Greenville, S. C.
Union Mills Paper Mfg. Co., New Hope, Penna.
*University of Wisconsin, Madison, Wisc.
*Vassar College, Poughkeepsie, New York
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Warfield Natural Gas Company, Harold, Kentucky
White Sewing Machine Co., Cleveland, Ohio
Whiting Plover Paper Company, Stevens Point, Wisc.

(*) *Represents repeat orders.*

AMERICAN ENGINEERING COMPANY, PHILADELPHIA, PENNSYLVANIA

ARE YOU BUYING YOUR STOKER BY THESE TWELVE POINTS?

1. **RELIABILITY**—the ability to operate with minimum outage and minimum standby equipment.
2. **CAPACITY**—the ability to provide adequate prime capacity ratings, with sufficient reserve capacity for emergencies.
3. **MAINTENANCE**—the ability to operate continuously with minimum repair costs.
4. **FLEXIBILITY**—the ability to follow the steam demand upward or downward . . . quickly and without sacrificing efficiency.
5. **EFFICIENCY**—the proved dollar efficiency (total cost of steam production) as shown by actual performance in similar installations.
6. **OPERATION**—the ability to operate continuously, the number and type of operations required, the ease of combustion adjustments, etc.
7. **ADAPTABILITY**—the ability to meet special and limiting conditions, present and future—structural limitations, utilization of present equipment, growth and change of power service demands.
8. **FUEL FLEXIBILITY**—the ability to burn efficiently and easily fuels from many sources having widely varying characteristics.
9. **REFUSE DISPOSAL**—the ability to economically eliminate ash or refuse and the opportunities of disposal at low cost, no cost, or profit.
10. **STACK DISCHARGE**—the practical elimination of "smoke nuisance" without special equipment.
11. **SPACE REQUIREMENTS**—the ability to conform to existing or future space limitations, to short and wide or long and narrow furnaces. Also the accessibility of component parts for maintenance and operation.
12. **OBSOLESCENCE** — the adaptability of the equipment toward possible future modernization with minimum of complication and outage.

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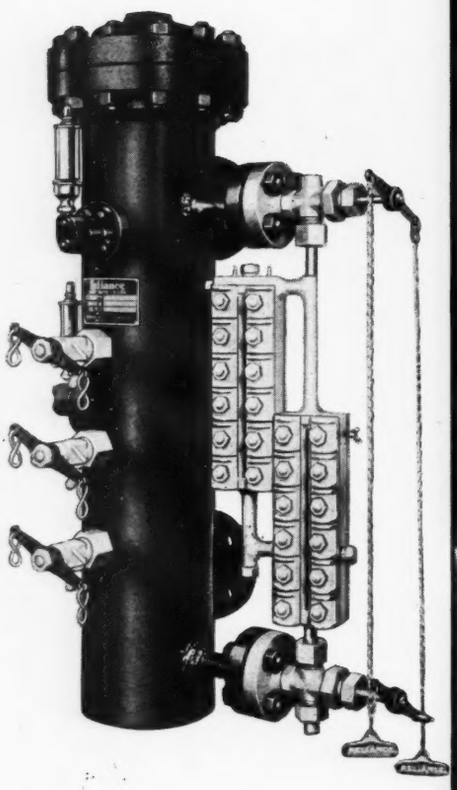
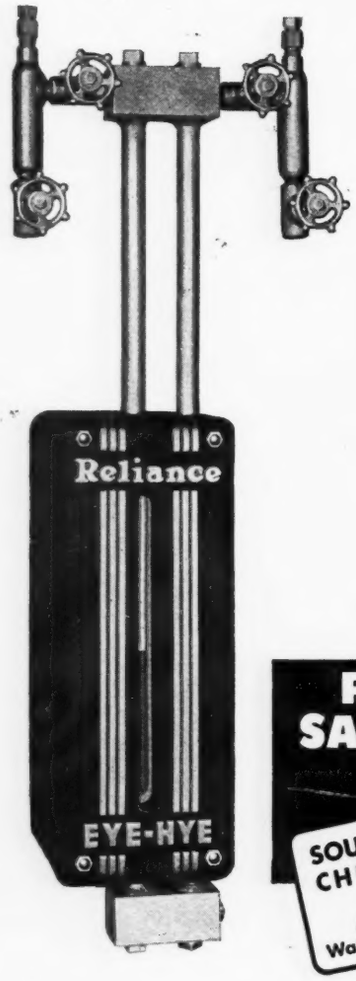
HOISTS, MARINE DECK AUXILIARIES

IT TAKES ALL THE POWER YOU CAN MUSTER TO





"Beat the Promise"

MORE POWER TO YOU—

And Here's How to Make Sure of it

The Reliance Gauge Column Company

5902 Carnegie Avenue

Cleveland, Ohio

Representatives in Principal Cities to Serve You

Mount and tack up this page in your boiler room

WHAT TO DO

To Keep Your Water Columns and Gages Protecting Your Boilers for the Duration

★ Maintenance schedules should cover boiler water level indicating equipment as thoroughly as any other vital operating devices. It will pay you to review these points of good boiler room practice. ★

1] Water Column. Open blowdown valve at start of each shift to flush sediment from column and to test low water alarm signal. *Open and close valve slowly to avoid water shock.* When operating conditions permit, raise boiler water level sufficiently to test high alarm signal, to insure constant readiness for emergency warning.

2] Gage Valves. Open blowdown valve at start of each shift to remove sediment. Observe speed at which water returns to proper level. This indicates whether gage valve ports are unobstructed. Keep packing tight around valve stem and glass —leakage wastes steam and causes dirty deposits that not only look bad but hinder operation when quick action is essential.

3] Gage Glass. Cleanliness is vital to good vision. Whether you are using tubular glass or an expensive insert, the glass must be *clean* for accurate reading. You know from experience how long a tubular glass may be used on your boilers before it is thinned to the danger point. Change glasses regularly. Also be sure tubular glasses have guards to prevent personal injuries from bursting glass.

4] Gage Glass Inserts. Prismatic and Flat Glass Water Gage Inserts, if used, should be inspected frequently for possible leakage. Expansion and contraction from temperature changes may loosen bolting pressure. A slight "take up" on insert clamping bolts may prevent blowing out of gaskets and reduce glass erosion.

5] Mica. Whether used as a protective coating to prevent glass erosion or as an insert window, treat mica with *utmost care.* All mica for this service is imported and replacement stocks definitely limited. When possible, mica should be cleaned with alcohol or other solvent and replaced in service. Otherwise salvage all mica possible by "splitting" and rebuilding to proper thickness with replacement sheets.

6] Illumination Equipment. Keep reasonably clean at all times to insure full visibility. Use proper size lamp. Most illuminators are constructed to focus maximum light rays from a definite location of lamp filament. Where mirrors are employed, check cleanliness and adjustment regularly.

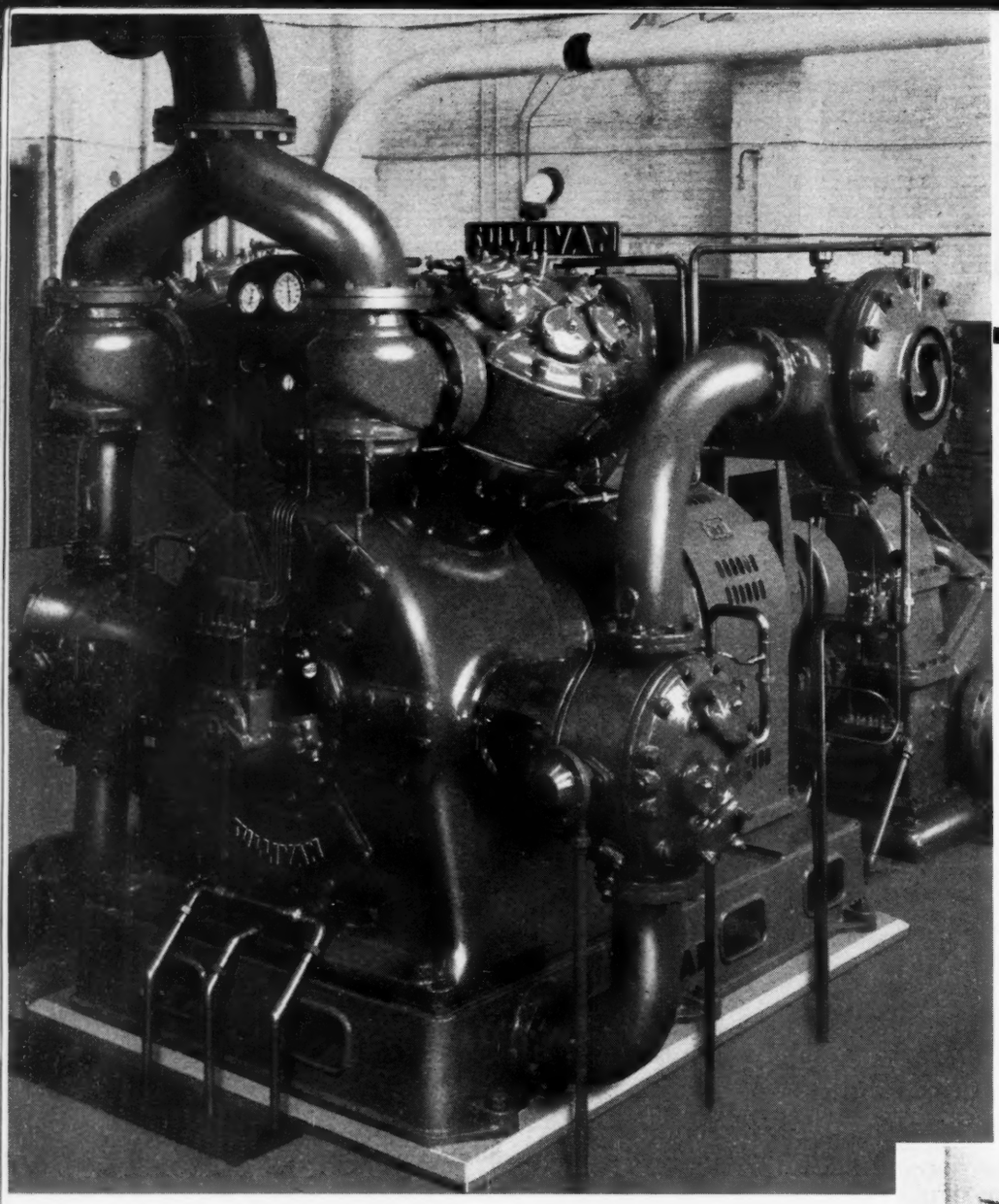
7] Gage Cocks. Test daily to insure readiness for emergency operation. Frequent testing causes less wear than occasional use because sediment is not allowed to accumulate in quantity. Never leave a gage cock "sizzling"— open it for blowdown two or three times if necessary to remove the scale which may cause wire drawing and an early repair job.

8] Remote Reading Indicators. Familiarize yourself thoroughly with the manufacturer's instructions for proper care and follow them in detail. Don't let an indicator remain in service which may be inaccurate. Hang a warning sign on it until it can be serviced — *remember the man on the next shift!*

TRADE MARK REGISTERED U. S. PAT. OFF.

Reliance

BOILER SAFETY DEVICES



Here

Sullivan
PACKAGE-TYPE COMPRESSORS

are two-stage, double acting, long-lived, heavy duty, continuous service compressors—much smaller than old style compressors of the same capacity—and yet have operating economies equal to or exceeding those of the older bulky units of the same capacity. "PACKAGE-TYPE" compressors need only to be hooked up to power, water and air lines and they are ready for 24-hour per day constant and efficient service. They are particularly suitable for synchronous motor drive and extremely well adapted for drive from steam turbines or diesel engines.

Are you plagued by any of these problems?

? How can you balance periodic demand for low pressure process steam with available sources of steam and electricity?

? How can you be certain that process steam is CLEAN AND FREE FROM OIL?

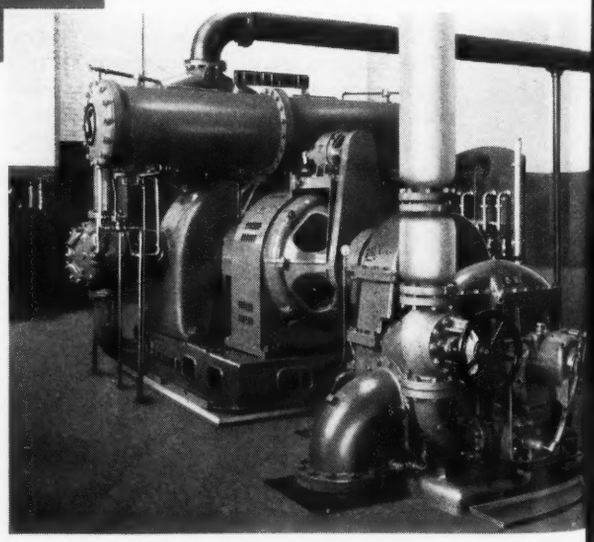
? How can you utilize modern high pressure, high temperature steam in relation to compressed air demand?

? How can you balance electrical load with peak demands without affecting your important air supply?

? How can you balance restricted boiler capacity with load demand?

These are just a few of the problems you can solve with these dependable, versatile, "Package-Type" heavy duty turbo/electric driven Air Compressors. Tell our engineers what *your* problem is. Get all information about the Sullivan "Package-Type" Compressor *now*.

S SULLIVAN *Products* SPEED PRODUCTION for VICTORY



Sullivan WN-114 "Package-Type" Compressor in Sullivan's own plant. Driven optionally by electric motor through flexible coupling or by steam turbine through pneumatic coupling.

SULLIVAN

PACKAGE TYPE *AIR* COMPRESSORS

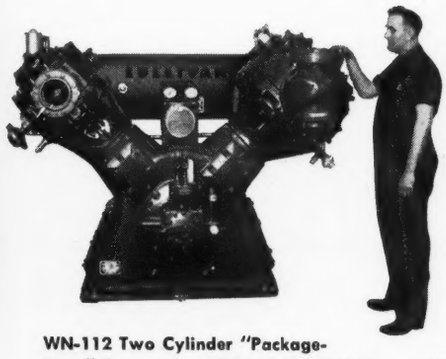
is Versatility for you!

The Inside Story of how, with its Own "Package-Type" Compressor, Sullivan's Own Plant Meets its Compressed Air Requirements . . . and Solves its Compressor Drive-Power Problem as well.

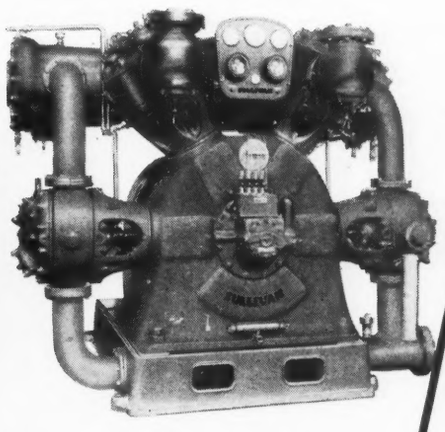
IN common with many large manufacturing plants, Sullivan has a problem of balancing its air and electrical power demands with many fluctuating conditions. In summer months Sullivan buys its electrical power from the local utility. To supply compressed air for various tools in the plant, it uses a WN-114 "Package-Type" Heavy Duty Air Compressor. In moderate weather and during the winter months the Sullivan plant supplies a substantial portion of its electrical requirements by means of steam driven generators. In moderate weather, when very little steam is needed for heating purposes, this 4-cylinder compressor plant is driven by a 200 h.p. synchronous motor, using surplus electrical power from Sullivan's own generators. In cold weather, when more steam is required for heating, the Sullivan compressor is driven by a steam turbine, in which case, the turbine is used as a reducing valve for the steam going into the heating system. During hours of electrical overload, as at night when the office and full shop force is working, a full and non-fluctuating supply of air for shop and tools and electricity for tools and lighting, must be supplied. In such a case, Sullivan uses its own generators to drive the compressor motor, if it is during the summer months, or uses the steam turbine, if in the winter time, the electric motor acting as a flywheel.

And, if you have a boiler but no generating equipment in *your plant* this turbo/electric combination of compressor drive can be used as an emergency generator drive by running the motor as a generator. This is particularly useful in case of blackout or other transmission troubles and during local power failures.

Here is compressor flexibility at its best. Coupled with the known dependability and long life of the Sullivan "Package-Type" Heavy Duty Compressor, unequalled compactness and space-saving ability, small foundation requirements, speed of installation and other advantages . . . this is the heavy duty compressor for you. A Sullivan sales engineer is always available to help in solving your air compressor problems.



WN-112 Two Cylinder "Package-Type" Compressor 378 to 1828 C. F. M. Maximum space requirements 8 feet long, 6 feet 8 inches wide; foundation 4 feet 2 inches long; 2 feet 11 inches wide.



WN-114 Four Cylinder "Package-Type" Compressor made in 4 sizes, in single and twin units. 175 to 600 h.p. 1092 to 3656 C.F.M. Floor space 9 feet x 10 feet. Foundation 5 feet x 8 feet.

FREE! . . . Write for reprints of this chart in poster form . . . size 18 x 24 in. Suitable for hanging in your plant.

WASTED AIR SLOWS PRODUCTION

Small Leaks in Compressed Air Lines Squander Thousands of Dollars Worth of Air Annually

CHECK FOR:

Worn valve washers—Valves not seating properly—Bad washers in hose connections—Misfit hose clamps—Hoses without nozzles—Hoses without cutoff valve near nozzle—Leaking pipe connections—Rusted, cracked or bent pipes.

Size of Openings	Cu. Ft. of Air Wasted per Month at 100 Lbs. Pressure	Cost of Air per Month per Opening. Based on 6c per 1000 C. F.
1/32	45,508	$ 2.73
1/16	182,272	10.94
1/8	740,210	44.41
1/4	2,920,840	175.25
3/8	6,671,890	400.31

For your Compressed Air Problems Consult SULLIVAN Manufacturers of Compressors From 1/4 to 3,000 H. P.
Compliments of Sullivan Machinery Co., Michigan City, Ind.

Copyright 1942

SULLIVAN MACHINERY COMPANY *Executive Offices:* MICHIGAN CITY, INDIANA

FACTORIES: MICHIGAN CITY, IND. • CLAREMONT, N. H. • DUNDAS, ONT. • GRANTHAM, ENG.

Associated House: Canadian Sullivan Machinery Company, Ltd., Dundas, Ontario

OFFICES

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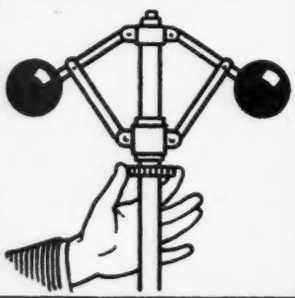
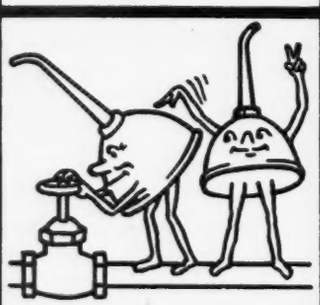
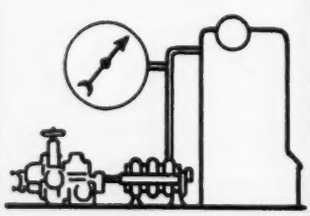
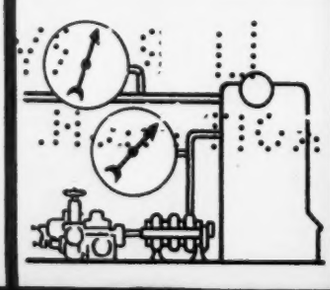
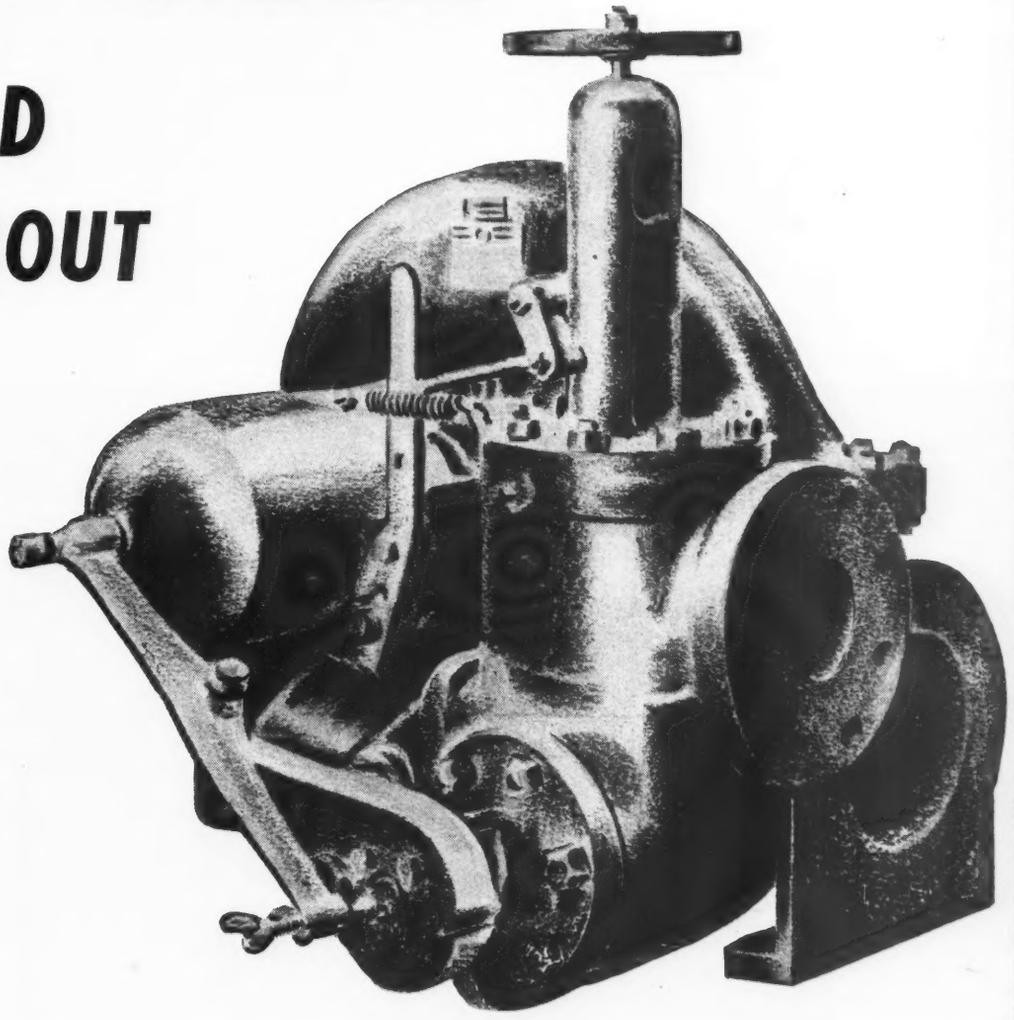
PRODUCTS

HEAVY DUTY, SINGLE OR TWO STAGE STATIONARY AIR COMPRESSORS IN ANGLE, V-VERTICAL, VERTICAL OR HORIZONTAL TYPES IN SIZES FROM ¼ TO 3000 H. P. ALSO A COMPLETE LINE OF PORTABLE COMPRESSORS

If it's ADJUSTABLE SPEED CONTROL *you want*

GENERAL ELECTRIC TURBINE GOVERNORS		SPEED ADJUSTMENT	REGULATION NO LOAD TO FULL LOAD	
CENTRIFUGAL-WEIGHT GOVERNOR		0	6%	With this type, the turbine speed is controlled by a horizontal, centrifugal-weight governor mounted on the end of the rotor shaft and connected through a linkage to the double-seated governor valve. In response to changes in speed, the weights travel in or out to open or close the valve. Knife edges and contact surfaces in this mechanism are hardened to reduce wear and minimize friction.
CENTRIFUGAL-WEIGHT GOVERNOR WITH HAND SPEED CHANGER		−10% +10%	6%	A hand speed changer can be built into the linkage of the centrifugal-weight governor described above. This varies the effective length of the valve stem to provide speed range by manual adjustment. It is always required on dual-drive applications to equalize the turbine speed with the motor speed.
DIRECT-ACTING OIL GOVERNOR		−66%	8 TO 20%	A shaft-driven, gear-type pump supplies oil direct for governing. Regulation is 8 per cent at maximum speed and 20 per cent at reduced speed.
OIL-RELAYED GOVERNOR		−10% +10%	4%	Where large valves must be controlled or where speeds are above 5000 rpm, oil-relayed governors are recommended for closer, more accurate speed control. The governor itself operates only a small pilot valve which relays the action of the governor to the governor valve. The governor acts as an indicator of the speed and supplies the small force necessary for operation of the pilot valve.
CONSTANT-PRESSURE REGULATOR		AUTOMATIC AS REQUIRED		Pump discharge pressure is piped to the diaphragm of a pressure regulator which directly regulates the governor valve on the turbine. The speed of the turbine is automatically adjusted to obtain a constant discharge pressure from the pump.
DIFFERENTIAL-PRESSURE REGULATOR		AUTOMATIC AS REQUIRED		This pressure regulator is equipped with two diaphragms—one piped to the pump discharge and the other to the boiler. The governor valve is controlled in terms of the difference in pressure on the two diaphragms. The differential-pressure regulator automatically adjusts the turbine speed to maintain pump pressure at a predetermined value above the boiler pressure.

...Here's the TURBINE YOU SHOULD KNOW ABOUT



NO one—industrial or utility—who is increasing capacity can afford to overlook the adaptability of mechanical-drive turbines to a wide range of speeds. Because turbines can always operate at the *right* speed, plant efficiency goes up, and drive costs go down. A turn of the hand speed changer sets the "ideal" speed; or, sensitive diaphragms automatically control discharge pressure on pumps and fans over the entire range of variations in steam pressure.

Every Type D mechanical-drive turbine is equipped with two types of governors—overspeed and operating—that function separately and independently. When speed becomes excessive, a through-bolt, spring-loaded, unbalanced weight strikes a trip device to instantly close a built-in combined trip and throttle valve. During normal operation the turbine speed is controlled by the operating governor, which makes use of a small variation in the speed being controlled or of a change in the controlled pressure acting on a diaphragm. G-E speed and pressure governors have a regulation just broad enough to assure stability. What's more, each type is designed to meet a particular set of requirements as to speed range, regulation, and operating characteristics.

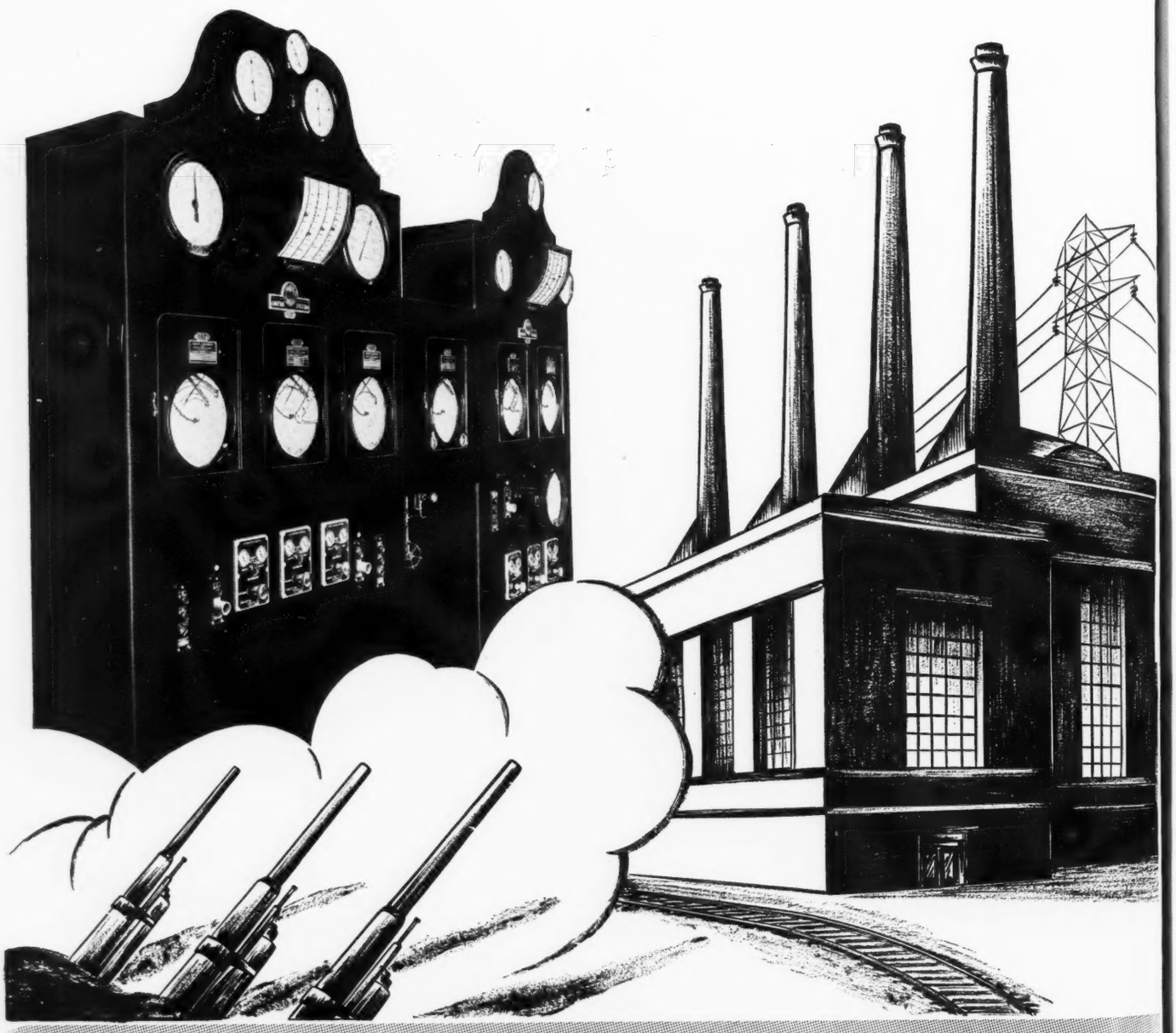
Because of their long and intimate experience with tough turbine-governing problems in many industries and utilities, G-E turbine specialists are good men to know. To get their help, all you have to do is call our nearest office, or write General Electric, Schenectady, N. Y.

General Electric and its employees are proud of the Navy award of Excellence made to its Erie Works for the manufacture of naval ordnance.

GENERAL ELECTRIC

262-9-480

ARMS FOR THE BATTLE



BAILEY METER CONTROL . . .

BOILER METERS • MULTI-POINTER GAGES • FLUID METERS • RECORDERS • SUPERHEAT

OF PRODUCTION

★ This is a mechanized war. Battles are being won by hard-fighting men who are well armed with modern equipment.

In the battle of production the boiler operator whose effectiveness is multiplied by Bailey Meters and Control is like the machine gunner who rides to battle in a jeep, tank or airplane. Both men are better able to serve because they use modern arms.

To win the battle of production, boilers must be kept in almost continuous service, maximum capacities must be secured, fuel must be conserved, men and equipment must be protected against accidents, and new manpower must be trained.

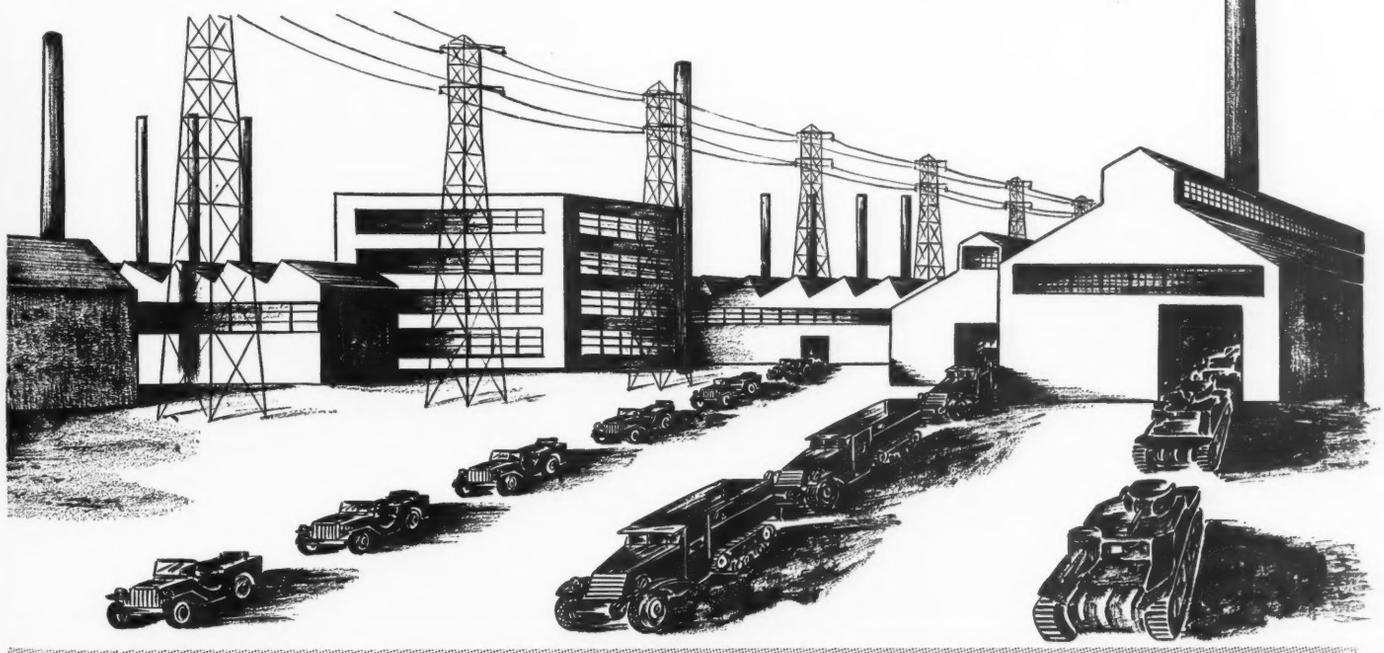
Bailey Meters and Control are helping to win this battle. They are modern arms for boiler room soldiers. By their use power engineers are able to:

1. Avoid frequent shutdowns for maintenance.
2. Stretch steaming capacity.
3. Reduce consumption of fuel.
4. Insure safety of men and equipment.
5. Maintain efficiency while training new operators.

Their use is explained in the bulletin "How to Safely Stretch Steaming Capacity", which offers suggestions for the solution of many of today's problems. To obtain a copy simply ask for Bulletin No. 16.

A-84

BAILEY METER COMPANY
1036 IVANHOE RD. • CLEVELAND, OHIO
Bailey Meter Company Limited, Montreal, Canada

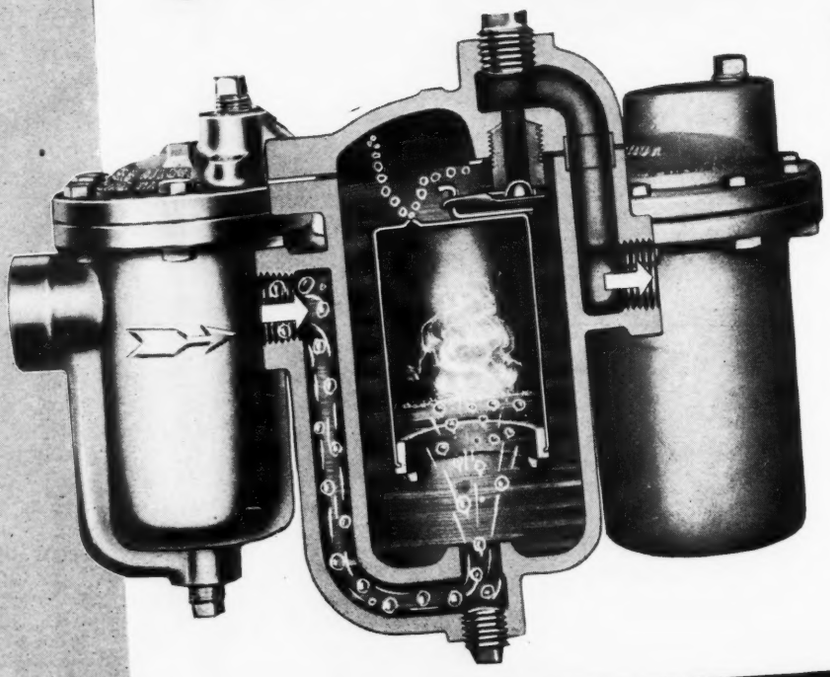


The Complete Combustion Control System

CONTROL • DESUPERHEAT CONTROL • COMBUSTION CONTROL • FEED WATER CONTROL

ARMSTRONG TRADE MARK

For "ALL-OUT"

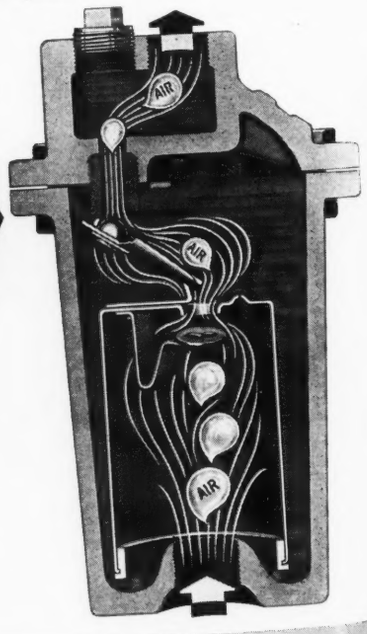


★ **BIG CAPACITY.** Armstrong's distinctive "free-floating" valve mechanism permits use of considerable larger discharge orifices than possible with ordinary lever arrangements.

★ **NO STEAM LOSS.** The Armstrong Trap is suitable for variable load conditions and no steam passes through the discharge orifice even when there is no condensate load.

★ **AUTOMATIC AIR ELIMINATION.** Any air entering the trap ahead of condensate or coming in with the steam passes through the small vent in the top of the inverted bucket. This air collects at the top of the trap and is discharged ahead of the condensate when the valve opens.

Use this special thermic vent bucket for EXTRA FAST air removal!

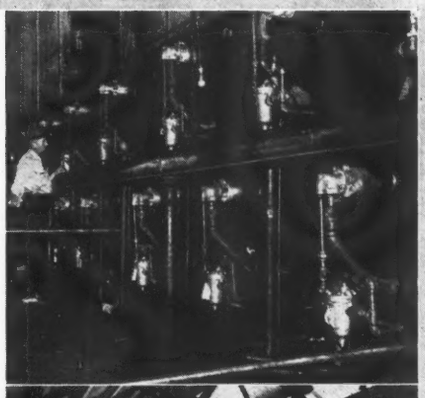


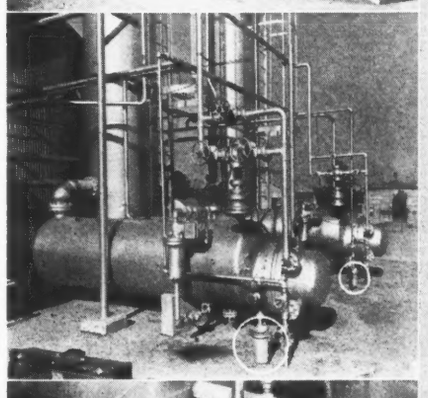
WHERE large amounts of air must be handled quickly when steam is first turned on, the use of an Armstrong Blast Trap will often work wonders in speeding up heating. An Armstrong Blast Trap differs from a standard trap only in that the inverted bucket is equipped with an auxiliary air vent which is controlled by a flat disc mounted at the end of a strip of rustless thermostatic bi-metal. Air and water blow straight through (see picture at right) until steam comes in and causes the bi-metal strip to bend upward, closing the auxiliary vent.

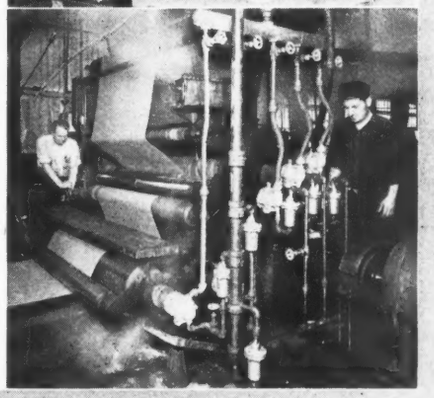
SEE OUR CATALOG IN SWEET'S

ARMSTRONG *Inverted Bucket*

SPEED
in the Battle of Production!







THE CALL has sounded for production equipment in countless plants to deliver maximum output without interruption. Throughout the land, where steam is used, Armstrong Traps are taking their place in the battle-line to blast out such subtle saboteurs of speed as SLUGGISH DRAINAGE, AIR BINDING, and SHORT-CIRCUITING.

SHORTAGE of fuel and rationing of power—the two menaces encouraged by inefficient utilization of steam—get no encouragement from Armstrong Steam Traps. Numerous users have reported that the steam saved by putting in Armstrong traps gave them the power equivalent to an extra boiler without the actual cost of putting in a boiler and firing it.

MILITARY STRENGTH and Industrial Efficiency go Hand in Hand! Time and man-power used up in wasted power, wasted steam, wasted fuel means just that much less potentially available for the main effort. Armstrong traps also protect users against excessive maintenance and loss of output.

ARMSTRONG offers a wealth of helpful, timesaving information to help users of steam secure peak performance. We will be glad to supply you with a copy of the newest edition of the popular 36 page Armstrong Steam Trap Book for solving virtually any condensate drainage problem encountered in an industrial plant. See your local Armstrong Representative or write.

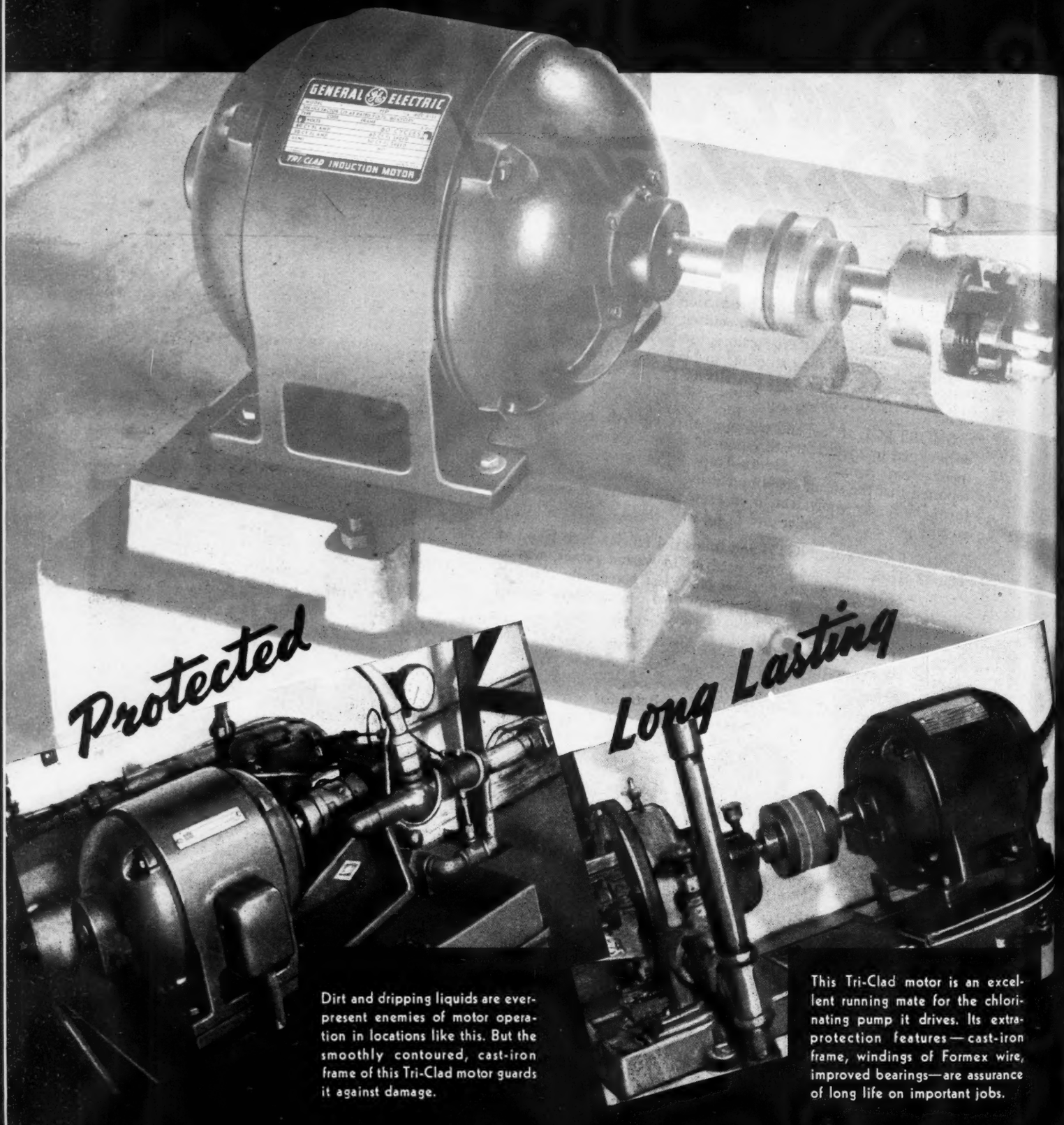
ARMSTRONG MACHINE WORKS

812 Maple Street Three Rivers, Michigan

STEAM TRAPS

Saving Fuel, Metals and Manpower for the Battle of Production

MORE" STAYING



Protected

Long Lasting

Dirt and dripping liquids are ever-present enemies of motor operation in locations like this. But the smoothly contoured, cast-iron frame of this Tri-Clad motor guards it against damage.

This Tri-Clad motor is an excellent running mate for the chlorinating pump it drives. Its extra-protection features — cast-iron frame, windings of Formex wire, improved bearings — are assurance of long life on important jobs.

BUILT FOR PROTECTION FIRST . . . TO LAST

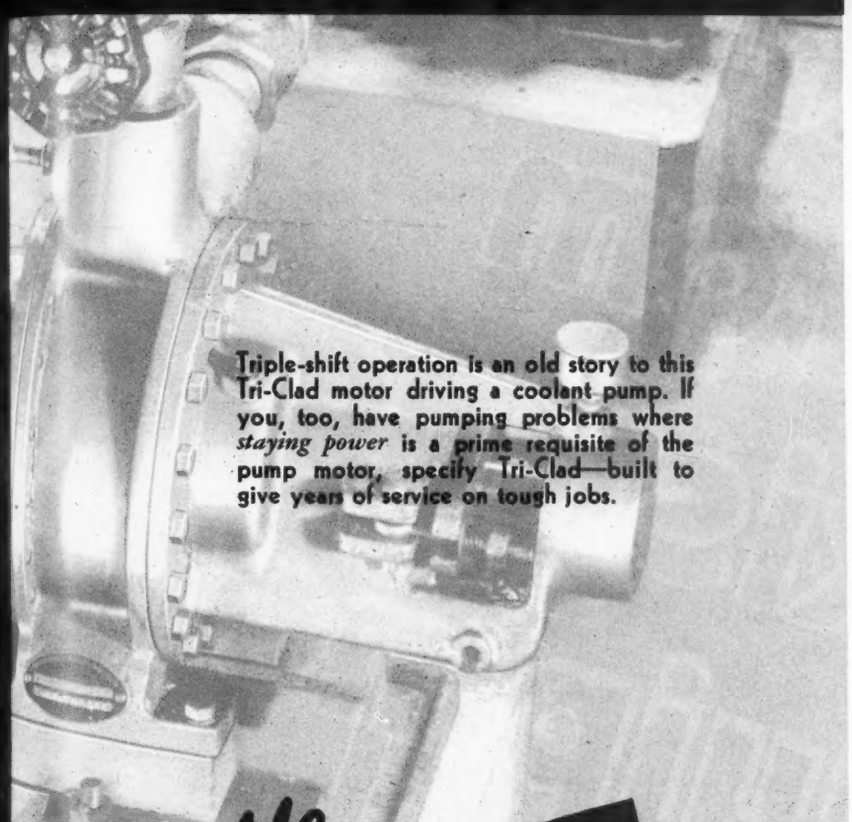
POWER" ON PUMPING JOBS

The extra protection of TRI/CLAD motors helps to keep pumps DELIVERING

NOW—before you buy motors—is the time to solve your pump-motor problems. Wherever continuous pumping is essential to your production—wherever pumps must operate under adverse conditions—your motors must be secure against (1) physical damage, (2) electrical breakdown, (3) operating wear and tear.

Here's where the *extra*-protection features of Tri-Clad motors will help you get the triple-shift operation you need. Their cast-iron frames and end shields exclude falling objects and dripping liquids; their windings, of Formex wire, are resistant to oil, moisture, and heat shock; their improved bearings, completely sealed in cast iron, are protected against the entry of dust and dirt. All these features add up to ***extra staying power*** on jobs where 24-hour production is essential.

You'll be glad to know that Tri-Clad motors are now available up to 100 hp in standard, open construction, and in a wide range of other types and ratings.



Triple-shift operation is an old story to this Tri-Clad motor driving a coolant pump. If you, too, have pumping problems where *staying power* is a prime requisite of the pump motor, specify Tri-Clad—built to give years of service on tough jobs.

Here's a Tri-Clad splashproof motor driving an important pumping unit in a midwestern plant. Its operation in a place where dampness and heat are often present is typical of the dependable service so characteristic of Tri-Clad motors.

NEED MOTORS?

Four Things to Do to Get Them Quicker

1 **USE STANDARD MOTORS.** Wherever possible, select standard, open, sleeve-bearing motors. Building fewer "specials" means faster and greater production of motors for you and others doing war work.

2 **PLACE ORDERS EARLY.** Order the motors when you order, or plan for, the equipment they are to drive.

3 **SEND PROPER PRIORITY.** Be sure correct priority papers accompany your order and that the priority rating reflects the urgency of the motor's use in the war effort.

4 **CHECK G.E.** for warehouse stocks. A supply of many standard motors is kept on hand to meet urgent war needs. Perhaps the motor you want, or can use with a few simple changes, is available for immediate shipment.

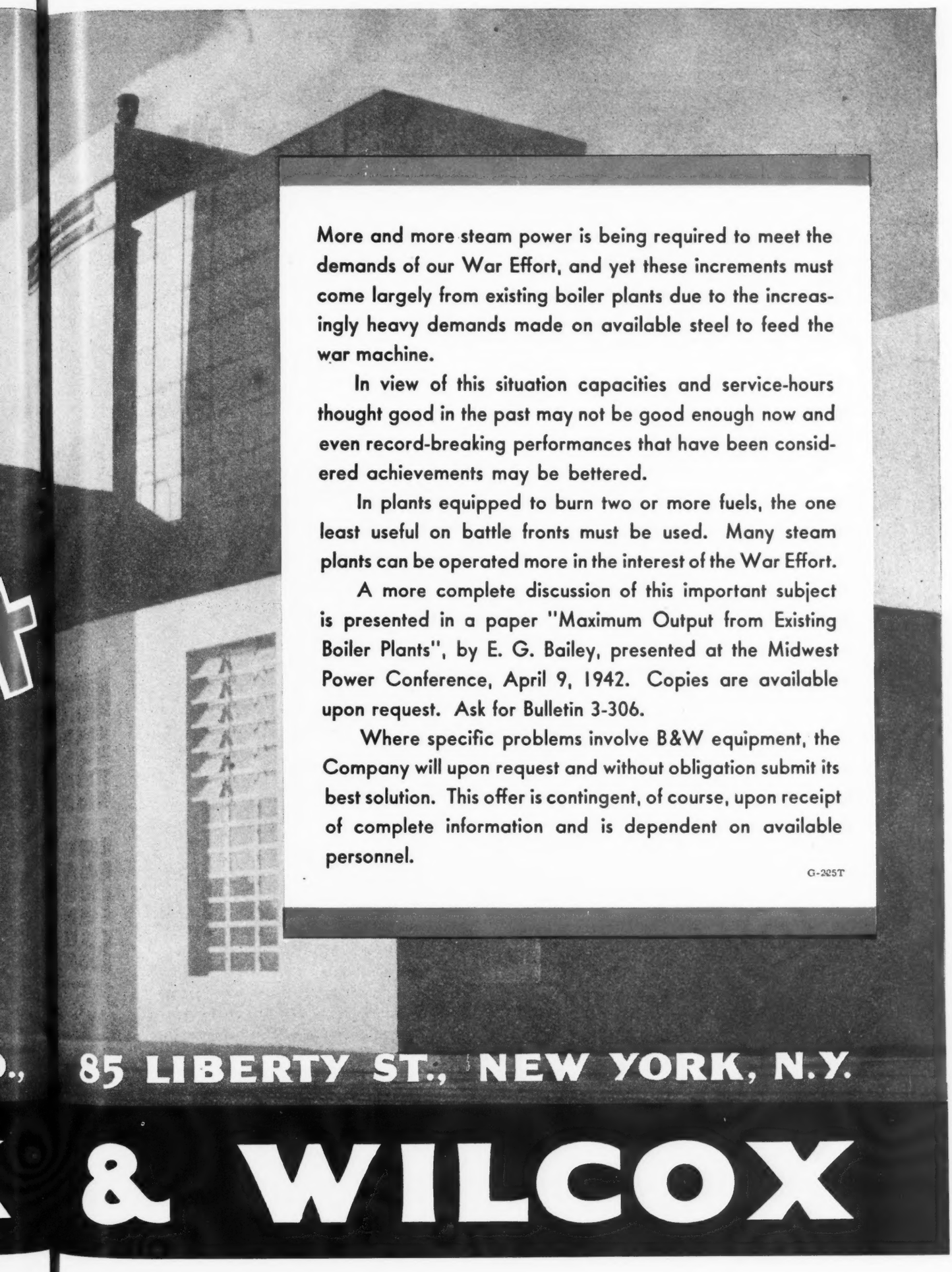
AND REMEMBER—keep the motors you have in top-notch shape. General Electric Company, Schenectady, N. Y.

General Electric and its employees are proud of the Navy award of Excellence made to its Erie Works for the manufacture of naval ordnance.

GENERAL ELECTRIC

750-108-8030

MORE STEAM
from
Existing
Equipment
THE BABCOCK & WILCOX CO.,
BABCOCK


More and more steam power is being required to meet the demands of our War Effort, and yet these increments must come largely from existing boiler plants due to the increasingly heavy demands made on available steel to feed the war machine.
In view of this situation capacities and service-hours thought good in the past may not be good enough now and even record-breaking performances that have been considered achievements may be bettered.
In plants equipped to burn two or more fuels, the one least useful on battle fronts must be used. Many steam plants can be operated more in the interest of the War Effort.
A more complete discussion of this important subject is presented in a paper "Maximum Output from Existing Boiler Plants", by E. G. Bailey, presented at the Midwest Power Conference, April 9, 1942. Copies are available upon request. Ask for Bulletin 3-306.
Where specific problems involve B&W equipment, the Company will upon request and without obligation submit its best solution. This offer is contingent, of course, upon receipt of complete information and is dependent on available personnel.
G-225T
85 LIBERTY ST., NEW YORK, N.Y.
& WILCOX

The TERRY

TERRY
SOLID WHEEL TURBINE
ADVANTAGES . . .

— The blades and the wheel (see above) are in one piece so that there are no parts to become loose or work out.

— The blades have large clearances.

— The blades are double rim protected.

— End play will not damage the blading.

— It is impossible for the blades to foul.

— The power producing action of the steam in the wheel takes place on the curved surfaces at the back of the buckets and, therefore, close blade clearance is not necessary.

— As the only function of the blades is to form a series of pockets, wear of the blade edges is of little consequence and does not materially affect the horsepower or efficiency. The important part of the bucket is the back, or bottom, which is a solid forging.

— The Terry wheel will withstand abuse that would wreck any built up wheel.

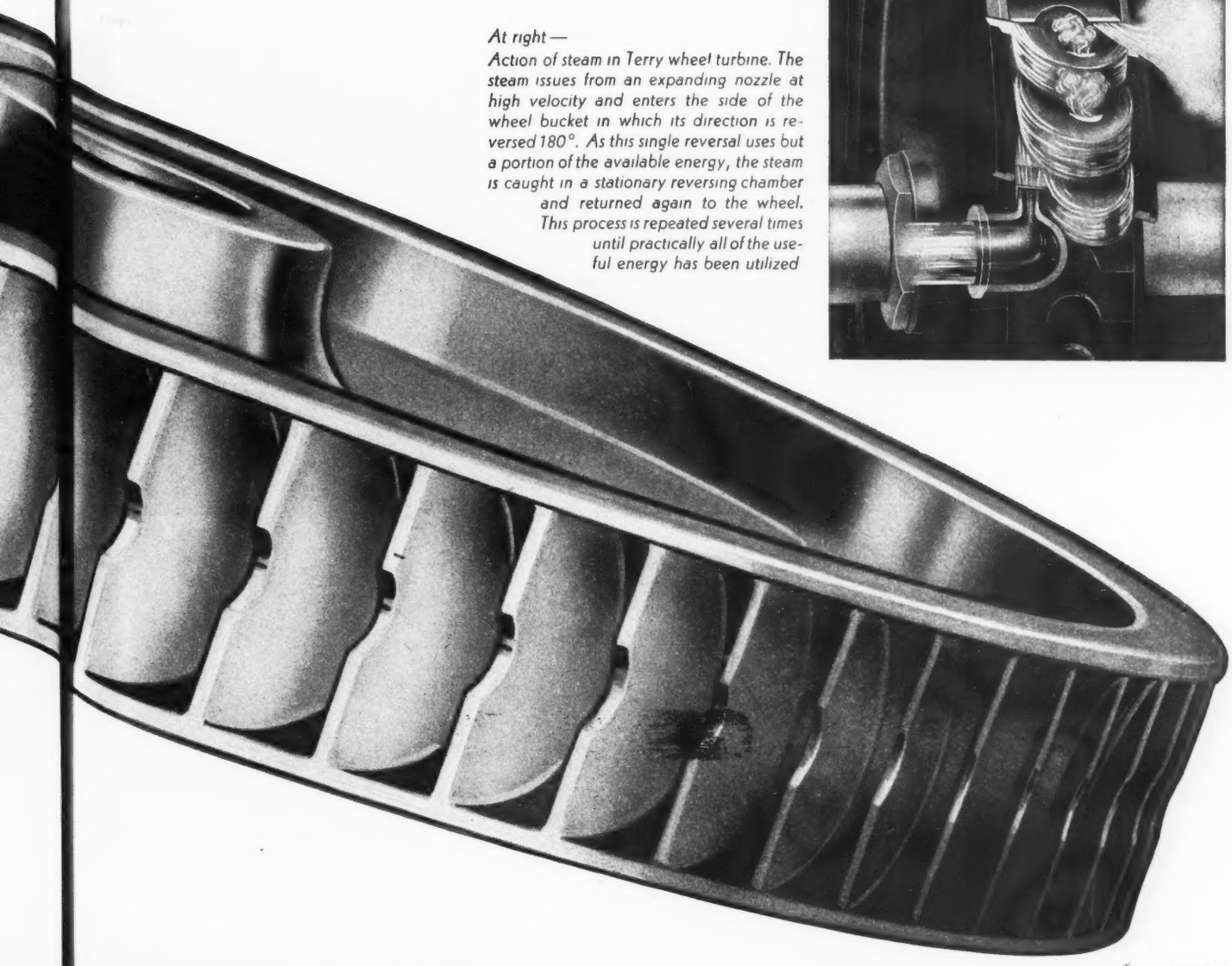
THE TERRY STEAM TURBINE CO.

Wheel Turbine

The Terry Solid Wheel Turbine is available in ratings from 5 HP to 2000 HP. It is built for all commercial steam pressures and exhaust pressures. Thousands of them are in daily service in central stations, industrial plants and on board naval vessels.

Full details of the Terry Solid Wheel Turbine will be gladly sent upon request. Ask for Bulletin S-116.

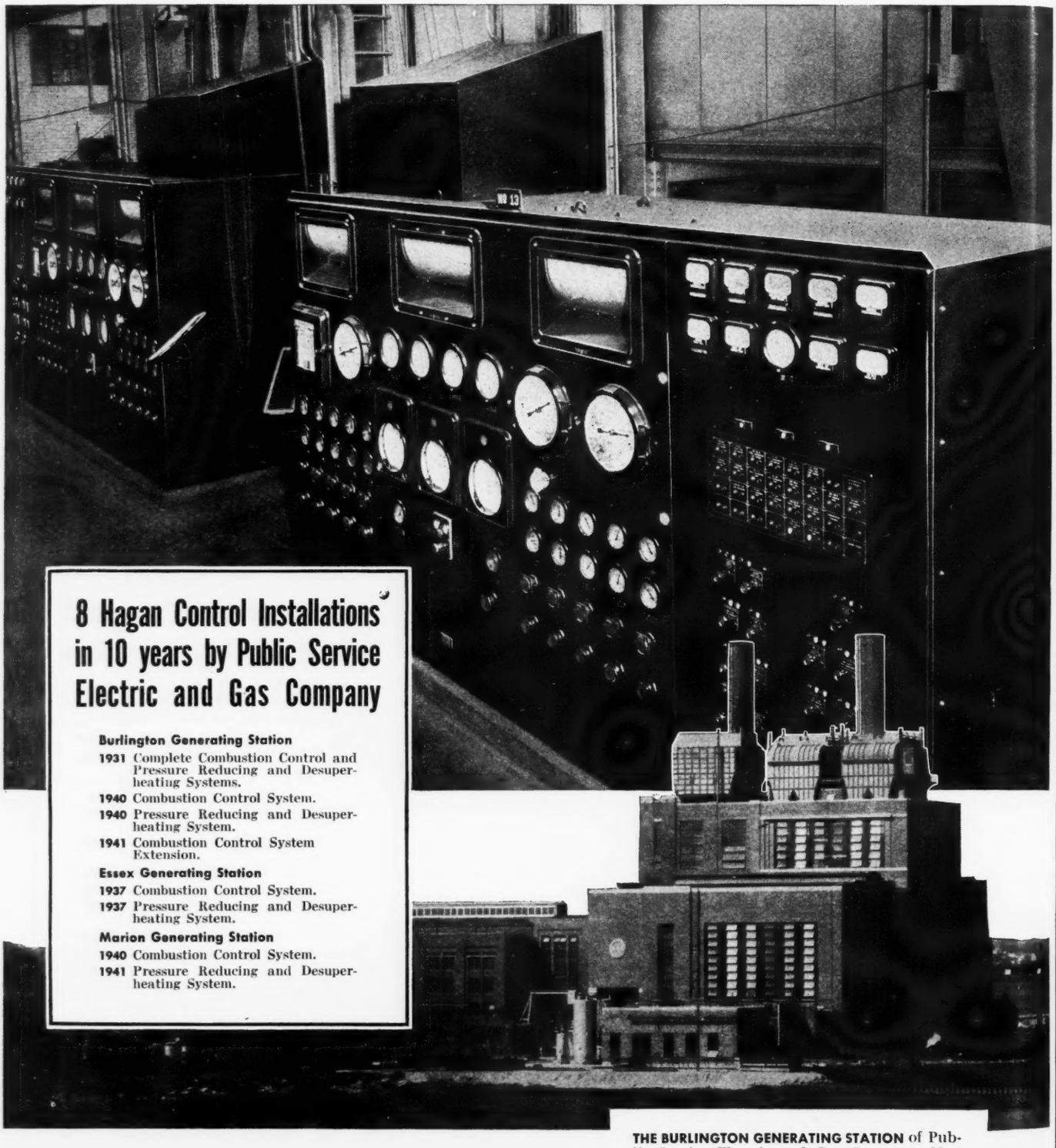
At right —
Action of steam in Terry wheel turbine. The steam issues from an expanding nozzle at high velocity and enters the side of the wheel bucket in which its direction is reversed 180°. As this single reversal uses but a portion of the available energy, the steam is caught in a stationary reversing chamber and returned again to the wheel. This process is repeated several times until practically all of the useful energy has been utilized



T-1147

TERRY SQUARE - HARTFORD, CONN.

Public Service Electric and Gas Company



8 Hagan Control Installations in 10 years by Public Service Electric and Gas Company

Burlington Generating Station

1931 Complete Combustion Control and Pressure Reducing and Desuperheating Systems.

1940 Combustion Control System.

1940 Pressure Reducing and Desuperheating System.

1941 Combustion Control System Extension.

Essex Generating Station

1937 Combustion Control System.

1937 Pressure Reducing and Desuperheating System.

Marion Generating Station

1940 Combustion Control System.

1941 Pressure Reducing and Desuperheating System.

THE BURLINGTON GENERATING STATION of Public Service Electric and Gas Company, New Jersey. Three Hagan Automatic Combustion Control installations have been made in Burlington Generating Station since 1931. These systems control boilers operating at 650 and 1350 pounds per square inch pressure.

No matter what the type, any boiler can be equipped advantageously with Hagan Control.

REORDERS HAGAN CONTROL SEVEN TIMES IN FOUR YEARS

New high efficiencies obtained by enlarged Burlington, Essex and Marion Generating Stations

PUBLIC Service Electric and Gas Company, Newark, N. J., has enlarged three of its five generating stations since 1937, installing new units in Burlington, Essex and Marion Generating Stations.

Because of the splendid results and reliable performance obtained with an original installation of Hagan Automatic Combustion Control in the Burlington Generating Station in 1931, *fully automatic* Hagan equipment was ordered for all three stations when the new additions were made.

When increasing power demands necessitated further expansion, Hagan Control was reordered to establish *fully automatic,* complete control in each station.

Despite this rapid and extensive growth, power was generated *when, where* and *as* needed, without interruptions, at new *high efficiencies.*

Combustion control is not entirely responsible for increased efficiency, but consider the matter on a reorder basis. Certainly *one* measure of excellence in a combustion control system is its *reorder* record among important users. In this case, *one* good job led not to another, but to *seven* additional jobs.

Similar records are common with Hagan Automatic Combustion Control. Reorders are built into *every* job. Every installation is designed to fit the *particular* job required, to *do* the job right, automatically, and to *keep* doing it right for years.

When planning an extension or a new control installation, it is wise to look first at the leader, for a *genuine* measure of value. It is even wiser to stop right there, for Hagan Control will cost less and give you greater satisfaction in the long run—and that is what counts.

Advantages of HAGAN AUTOMATIC COMBUSTION CONTROL

INCREASED EFFICIENCY through correct proportioning of fuel and air.

CONSTANT STEAM PRESSURE.

EVEN DISTRIBUTION OF LOAD among boilers, or division as desired.

MAXIMUM STEAM OUTPUT per pound of coal.

MAXIMUM EFFICIENCY with minimum supervision.

FAST, RELIABLE OPERATION without hunting.

SIMPLICITY and ease of installation.

ELIMINATION OF SMOKE.

LOWER POWER COSTS.

THE ENGINEERING EXPERIENCE *of the pioneers in automatic combustion control.*

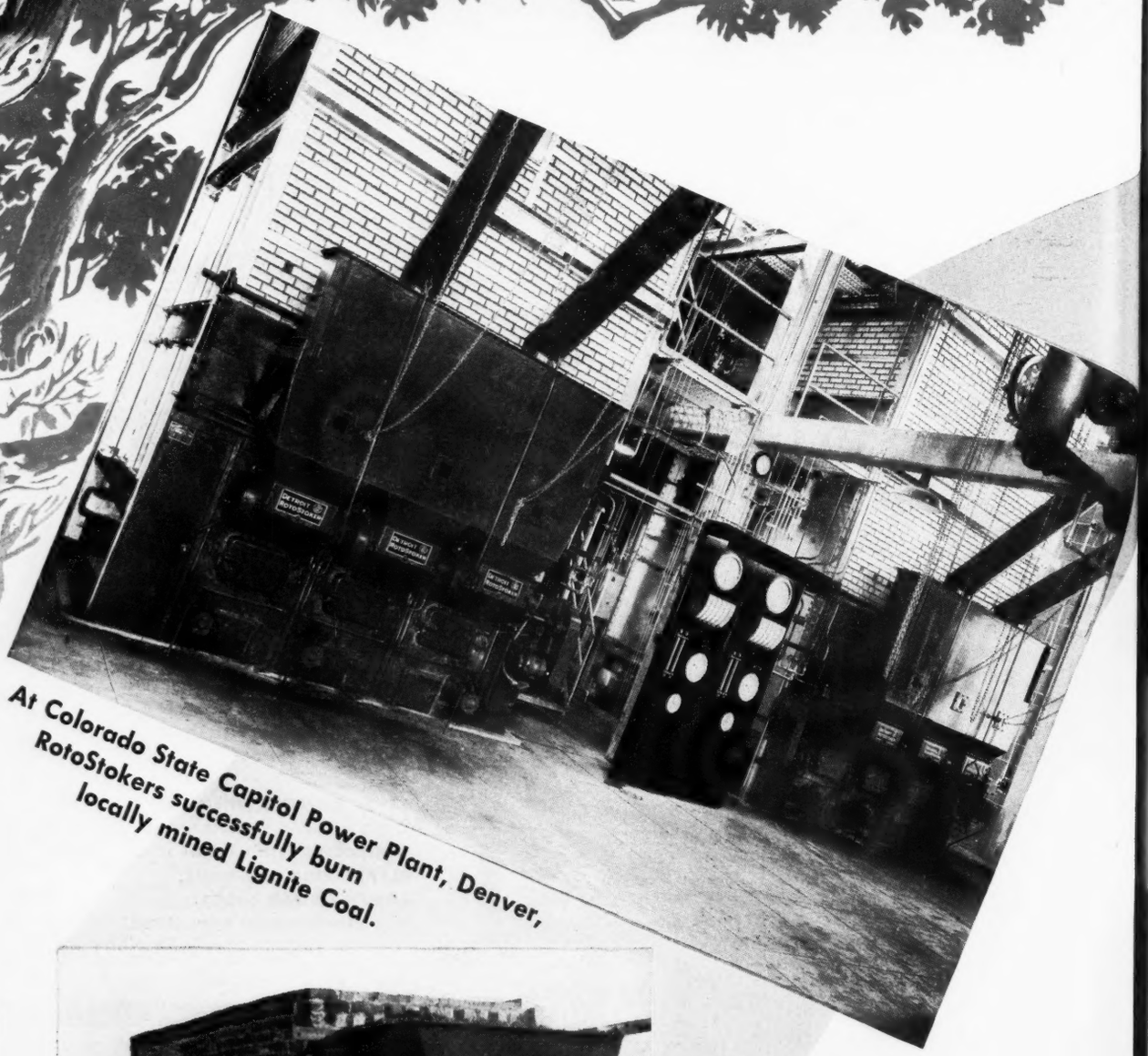
HAGAN CORPORATION · 300 ROSS STREET · PITTSBURGH, PA.

HAGAN *Automatic* COMBUSTION CONTROL

The pioneer . . . and still the leader

TALL OAKS

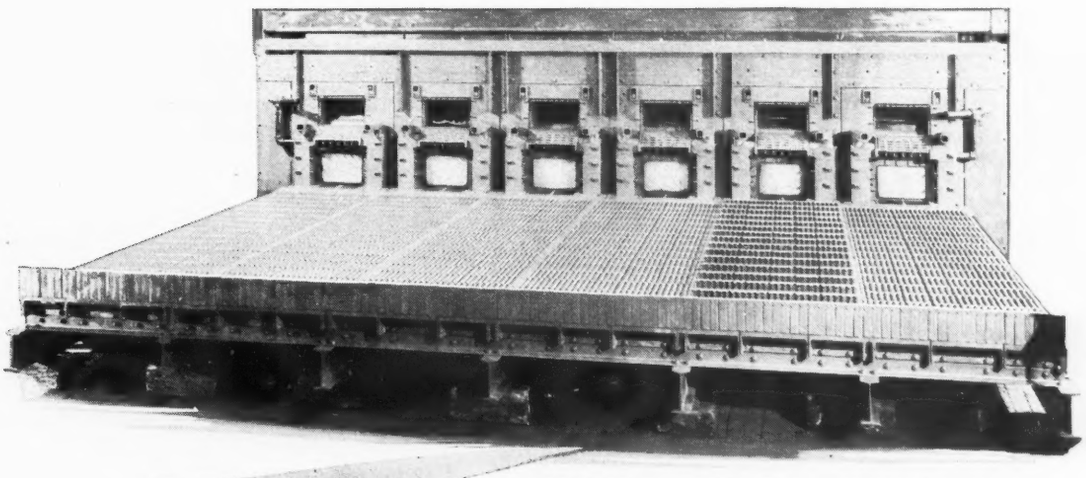
From Little Acorns Grow



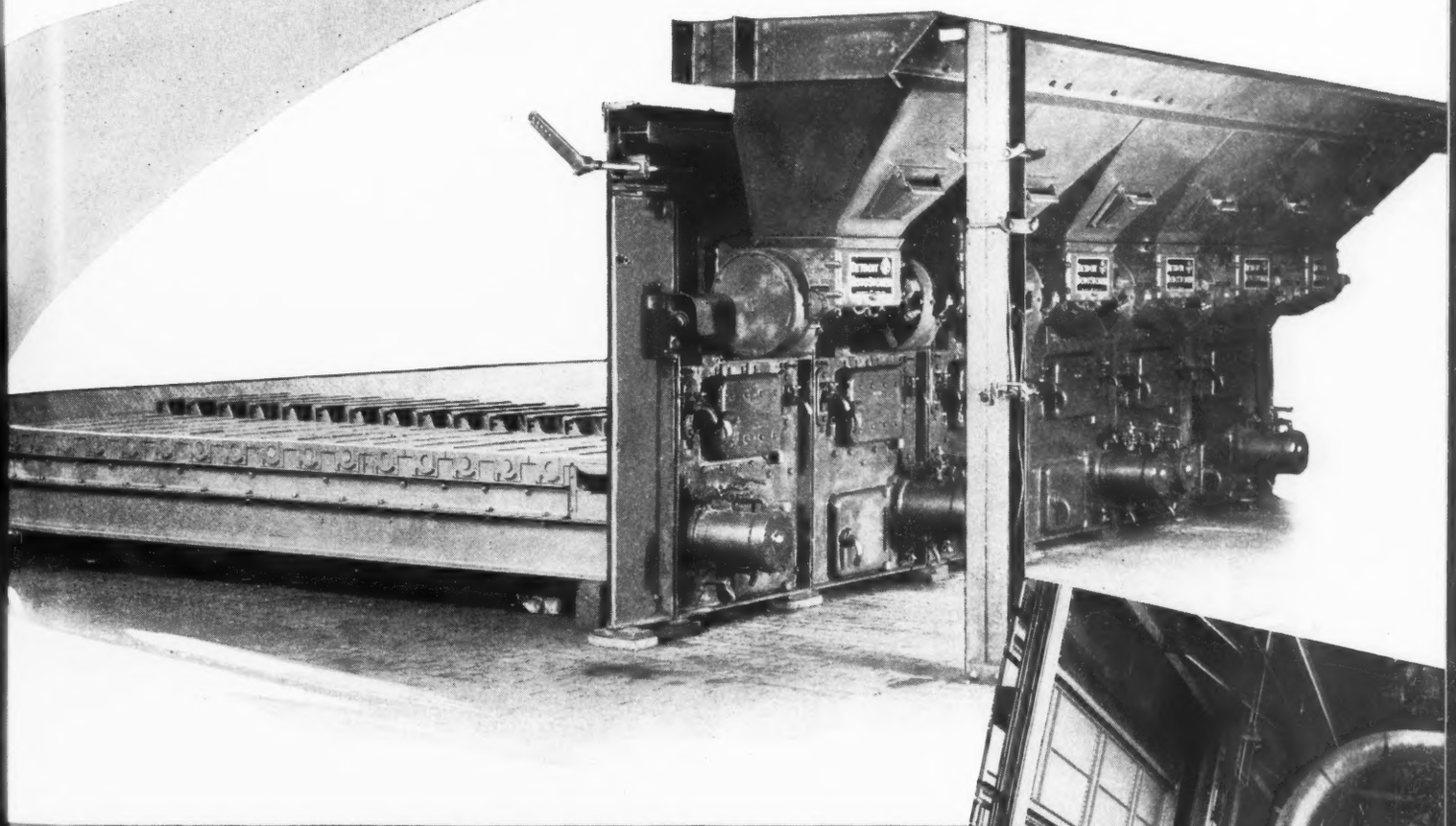
At Colorado State Capitol Power Plant, Denver, RotoStokers successfully burn locally mined Lignite Coal.

Operation of this small experimental model was observed under fire with various fuels.

DETROIT



Designed to generate over 100,000 pounds of steam per hour.



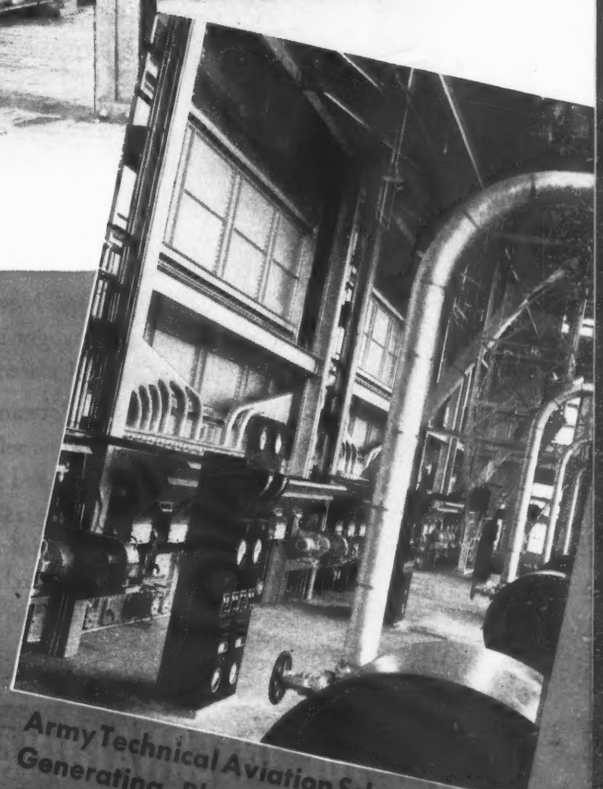
Months—even years of development work precede the final testing under fire of every type of Detroit Stoker. The RotoStoker was no exception. It took root from a small experimental model over ten years ago. From this, it has grown until large capacities are being generated with an extremely wide range of fuels.

Write for Bulletin 830

DETROIT STOKER COMPANY

FIFTH FLOOR, GENERAL MOTORS BUILDING
DETROIT, MICHIGAN
Main Office and Works—Monroe, Michigan

ROTOSTOKERS



Army Technical Aviation School Steam Generating Plant. 400,000 pounds per hour—seven Detroit RotoStokers.

Conversion TO WAR PRODUCTION CALLS FOR MORE INFORMATION ABOUT ALLOYS...

Conversion to war production makes great demands upon both plants and personnel. While altering plant layouts, experienced employees must be taught correct methods of handling new operations on different metals. New employees must be trained...and taught to avoid waste and spoilage of critical materials.

You can *quickly* obtain practical answers to questions about the selection, fabrication and uses of ferrous and non-ferrous alloys containing Nickel by asking us. We have on hand a fund of information collected through years of research, field studies and experiences of alloy users.

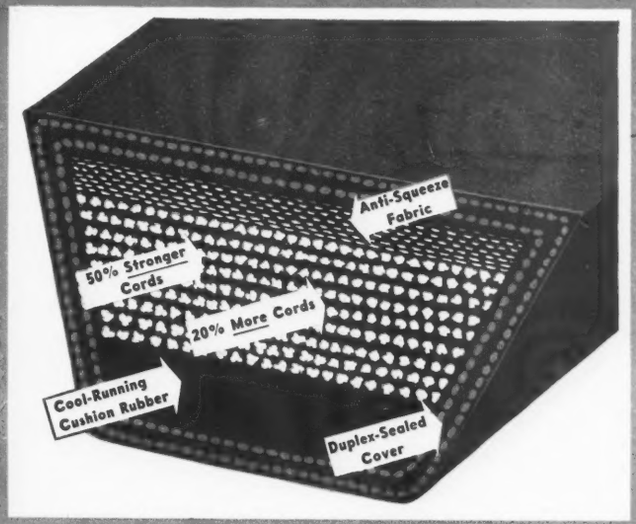
This data has been checked and edited into convenient charts and pamphlets. These printed pieces range from technical data for engineers to simplified guides for apprentices.

Now...with minutes and materials so vital to Victory...make full use of this metal-working experience. Our technical staff also offers personal assistance in overcoming problems created when Nickel was allotted to places where it serves the Nation best.

★ ★ *Nickel* ★ ★

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK, N. Y.

TEXROPE* SUPER-7 GIVES YOU THREE LIFETIMES IN ONE!



1 **50% STRONGER CORDS!** Sensational new Flexon process makes cords 50% stronger than even those in former great Texrope belts.

2 **20% MORE CORDS!** Count them! You get 20% more of these tough, extra pulling power cords in every Texrope Super-7.

3 **INCREASED LIFE!** Cords float on amazing cool-running cushion rubber that absorbs shock . . . actually increases belt life phenomenally.

4 **EXTRA PROTECTION!** Exclusive duplex-sealed cover protects pulling cords against dirt, grit, moisture, and other adverse elements.

ALL THEY used to ask of power transmission was one-shift-a-day . . .

NOW it's *three* top-speed shifts, seven days a week, in plants all over the country! Yes — and it's the extra built-in strength of the new Allis-Chalmers Texrope Super-7 V-belts that lets you get these *three lifetimes in one!*

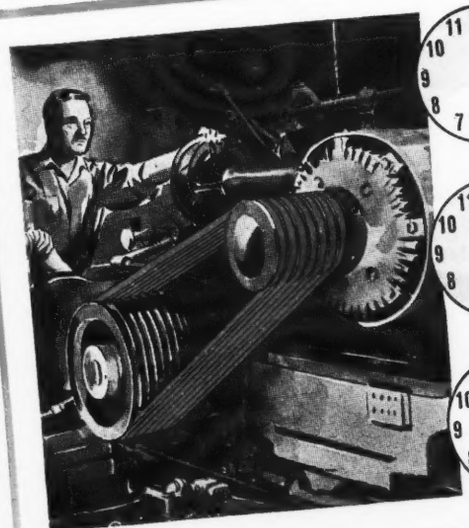
50% stronger cords! 20% more load-pulling cords! That's the kind of news hard-pressed operators like to hear today.

And there's more to the Super-7 story. There's the new rubber shock-absorbing section that helps keep belts cool even when operating *continuously.* There's the duplex-sealed cover for extra protection against grit, dirt, and moisture.

Don't forget — Super-7 is the newest V-belt on the market . . . it's stronger, longer-wearing, with top transmission efficiency . . . and it's four ways better!

If you want a V-belt that will give you "three lifetimes in one," see your Texrope dealer or the engineer in the Allis-Chalmers district office near you. Or write Allis-Chalmers, Milwaukee, Wisconsin.

Available in all sizes
½ hp to 2,000 hp



8 to 4 SHIFT!
Texrope Super-7 V-belts give you smooth, silent, slipless, high-efficiency performance to do a completely dependable wartime job!

4 to 12 SHIFT!
Texrope Super-7 V-belts still going strong . . . with rubber shock-absorbing section helping to keep belts cool even when operating continuously.

12 to 8 SHIFT!
With load-pulling cords 50% stronger, and 20% more of them, Super-7 V-belts have extra built-in strength to give you "three lifetimes in one."

A 1497

*Trade mark registered U. S. Patent Office. Texrope Super-7 Belts are the result of the co-operative research and design genius of *two* great companies — Allis-Chalmers and B. F. Goodrich — and are sold exclusively by Allis-Chalmers.

ALLIS-CHALMERS
MILWAUKEE·WISCONSIN

"MAKE MINE RUPPERT"

YOU COULDN'T ASK FOR BETTER

JACOB RUPPERT
BREWERY
1639 THIRD AVENUE, NEW YORK
TELEPHONE ATWATER 9-1000
N.Y.S.L.A.LIC.No D-1

GEORGE E. RUPPERT, PRESIDENT
J. RUPPERT SCHALK, VICE-PRESIDENT
H. GARRISON SILLECK, 3RD, SECRETARY
FREDERICK M. LINDER, TREASURER

February 6, 1942.

Mr. G. J. Nicastro,
Combustion Engineering Company,
200 Madison Avenue,
New York, N. Y.

Dear Sir:

Your letter of January 27th, addressed to Mr. Schuler, Plant Superintendent, has been directed to my attention.

In reference to the three VU type steam generators installed at our brewery, I wish to state that these generators have given us three consecutive years of uninterrupted and highly satisfactory service since their installation.

Although there are three boilers installed, only two are in operation at the same time, the other one being held as a spare. In case of emergency, one boiler is able to take the normal maximum load for a period of three hours.

With reference to efficiency, we wish to say that while generating steam at 410 lbs. Pressure, 650° Fahrenheit, with the load varying from 30,000 lbs. per hour to 65,000 lbs., we have averaged 12.5 lbs. of steam evaporated per pound of coal, or 125 lbs. of steam evaporated per gallon of oil. The above figures are taken from a monthly average. This comparatively new boiler installation is much more efficient that the former boiler plant when it is considered that 8½ lbs. of water evaporated per pound of coal was good performance in the old plant.

In addition to greater efficiency and reliability, the new boiler installation offers great flexibility. Either pulverized coal, or oil, can be burned depending on the economics involved, and the boiler can be switched from one fuel to the other in less than one minute.

In closing, I wish to say that I am, personally, highly satisfied with the performance of these boilers and all their incidental equipment.

Yours very truly,

George E. Ruppert

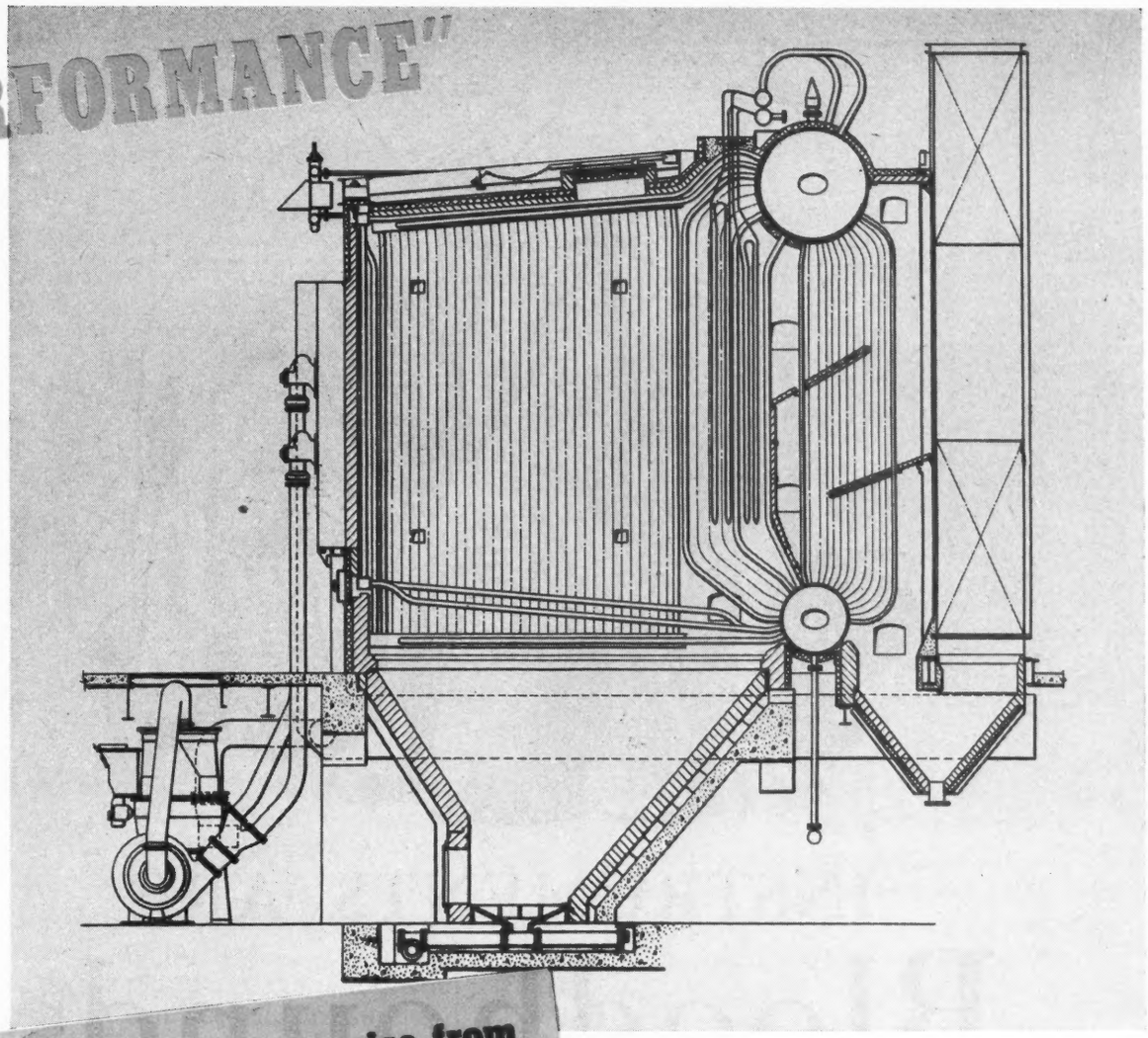
George E. Ruppert, President.

GER:H

C-E PRODUCTS INCLUDE ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS, AND AIR HEATERS

COMBUSTION

"PERFORMANCE"



A report of 3 years' Service from 3 VU STEAM GENERATORS AT JACOB RUPPERT BREWERY

Typical of the performance of V U Steam Generators throughout industry, is this record of efficiency, reliability and low-cost operation turned in by three V U Units which have just completed three years of service in the modern power plant of the Jacob Ruppert Brewery.

Continuous Service

In the words of President George E. Ruppert (letter on left page), the three V U Units have provided "three consecutive years of uninterrupted and highly satisfactory service."

Economical Operation

Monthly average evaporation of 12½ lb of steam per lb of coal is 50% more than the best performance obtained from the previous boilers.

Speedy Fuel Change-Over

The V U Units, which are designed to burn either pulverized coal or oil, can be switched from one fuel to the other in less than one minute.

Low Bowl Mill Maintenance

The pulverizer equipment, which consists of three C-E Raymond Bowl Mills, has provided three years of typically satisfactory service marked by quietness of operation and negligible maintenance.

A-655

COMBUSTION ENGINEERING COMPANY, INC., 200 MADISON AVENUE, NEW YORK, N. Y. • CANADA: COMBUSTION ENGINEERING CORPORATION, LTD., MONTREAL

ENGINEERING

INSTRUMENTS ARE Bloodhounds

FOR TRACKING DOWN POWER LOSSES THAT HAMPER PRODUCTION

★

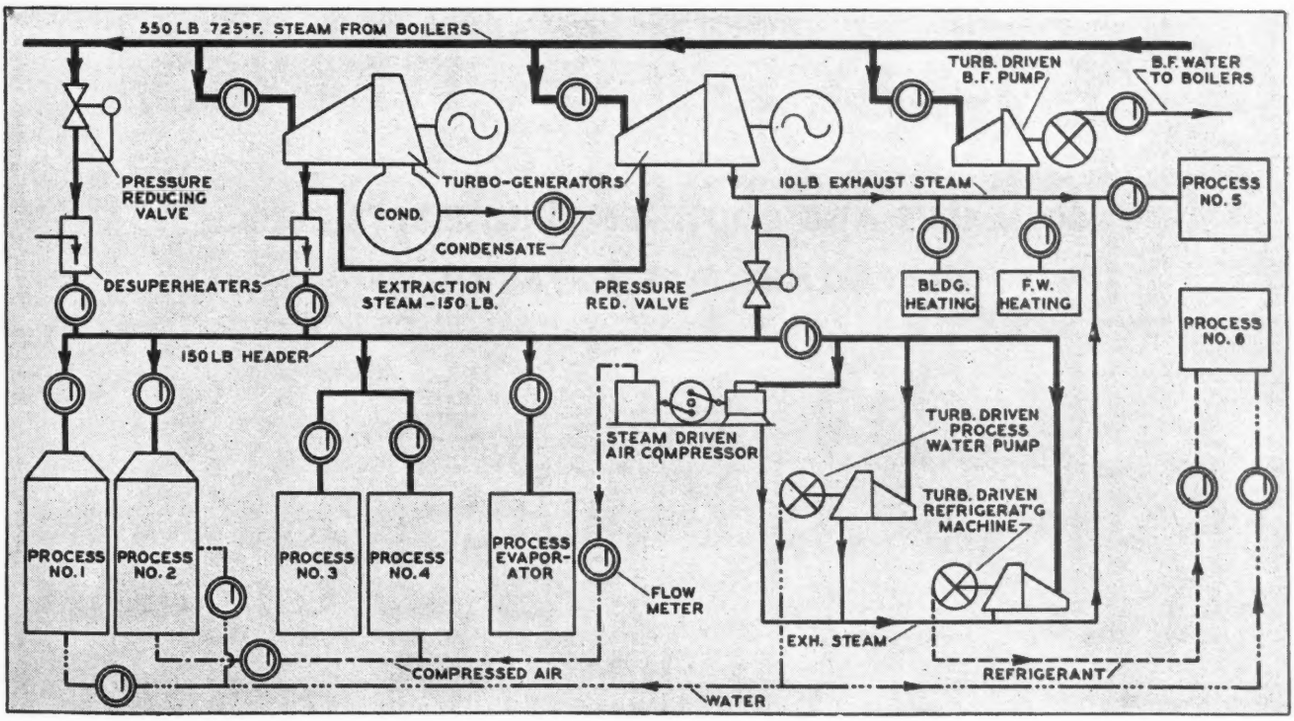
To meet your increased steam demand, you are stretching the capacity of your boilers through shrewd operation—you are generating 11 lb. of steam for every pound of coal you burn. Great!

But how much are you gaining if the rest of your plant wastes the steam?

All the effort and engineering skill you are expending to stretch your boiler capacity to meet present emergency conditions can be nullified by wasteful use of the steam produced.

Instruments are the bloodhounds that track down these steam losses. Anything that *re-*

EQUIPMENT • FACILITIES • PERSONNEL • EXPERIENCE
REPUBLIC INSTRUMENTS AND CONTROLS



duces the power consumption of pumps, compressors, dryers or other steam consuming units *increases* the *effective* capacity of your power plant.

The only accurate and reliable check on the use and abuse of steam, water, compressed air and other power plant services is to install flow meters (and, when needed, pressure and temperature recorders) on the supply lines to the various power consuming units. Only through an instrument installation of this type can operator and department head alike be provided with the data that will enable them to immediately locate and correct faulty or wasteful operating conditions.

MEASURING VERSUS GUESSING

The accompanying diagram shows a typical distribution meter system that provides a continuous picture of the consumption of power plant services by departments and processes, individually and collectively.

Total amount of steam consumed by prime movers and auxiliaries is measured, as well as the amounts supplied by extraction and exhaust to the various pressure systems serving process and heating loads. Actual consumption of steam, water, compressed air and refrigerant by individual departments, and even individual processes, is accurately and continuously metered instead of being merely estimated.

SPOTTING THE LOSSES

Methods of reducing this consumption can be quickly spotted by studying the peculiarities of operation revealed by the graphic records. These, in conjunction with process production figures, will indicate when and why a department or process uses more of a power plant service than necessary.

Republic engineers will gladly consult with your own engineers on any distribution metering problems you may have. They will show you how Republic meters can help you eliminate power service losses in your production departments. Ask today to have a Republic engineer call at your plant. Your request will involve no obligation on your part.

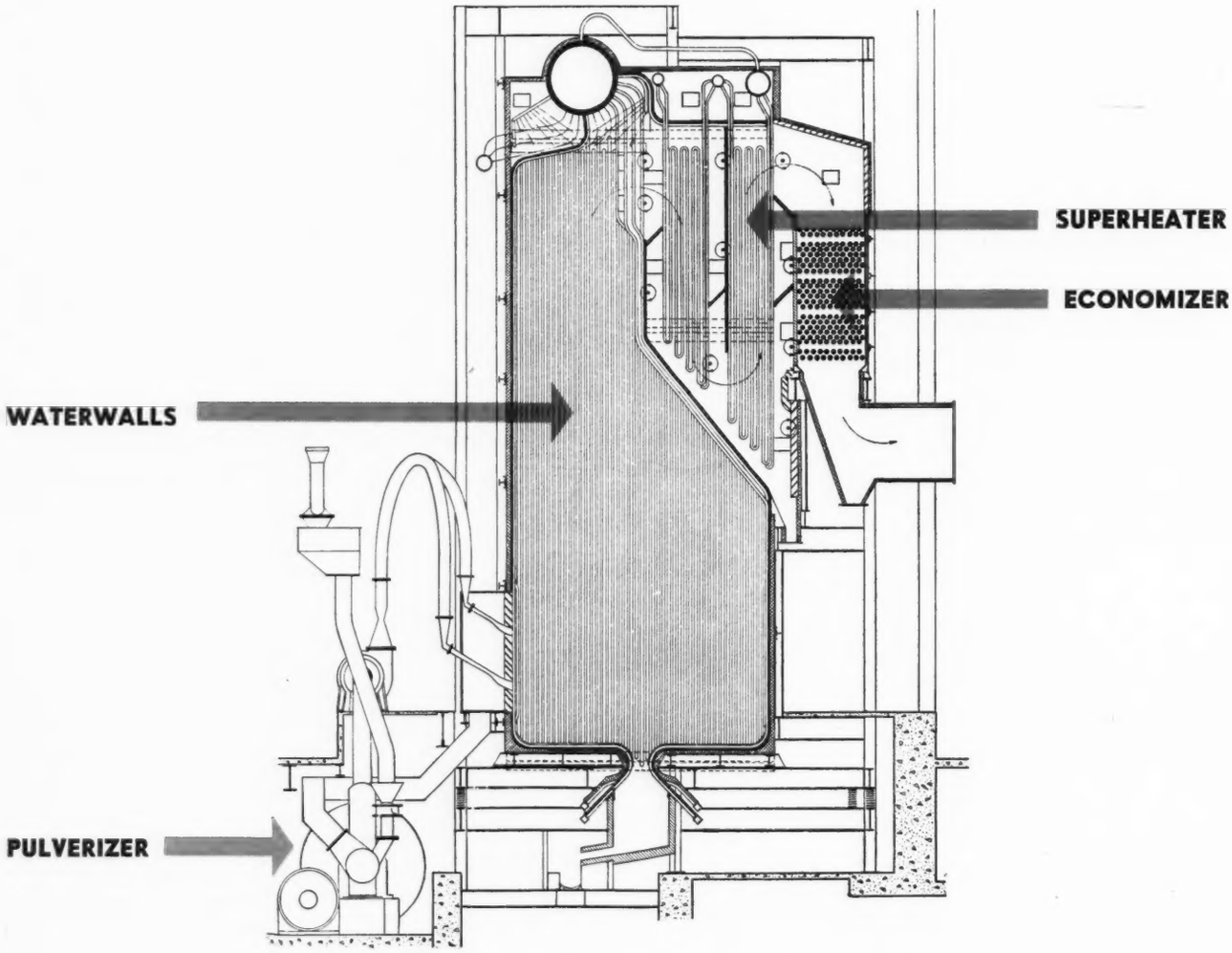
Republic Flow Meters Co.

2222 Diversey Parkway • Chicago, Illinois

WHAT IS THIS

COLUMBUS AND SOUTHERN OHIO ELECTRIC CO.

WALNUT STREET STATION



Maximum Load: 325,000 lb., steam per hour, 1400 lb., per sq. in. pressure, 900° F. final steam temperature

Foster Wheeler Corporation,

FOSTER

BOILER RATING?

The heating surface of this modern steam generator* is comprised of the following heat absorbing areas:

	Percent of total heating surface
SUPERHEATER	**42.6**
ECONOMIZER	**37.2**
WATERWALLS	**20.2**
BOILER TUBES	0

For 44 years Foster Wheeler has pioneered in the development of pulverized fuel systems and the three heat absorbing surfaces essential for modern central station steam generating units.

1898 **PULVERIZED FUEL** developed on a commercially successful scale.

1904 **SUPERHEATERS** — introduced the commercial use of superheated steam in the United States.

1919 **ECONOMIZERS**—introduced the forced circulation, high draft loss, counter-current, unit economizer.

1923 **WATER COOLED WALLS** for many types of furnaces burning various fuels.

* Exclusive of regenerative air heater

165 Broadway, New York, N. Y.

WHEELER

they watched

their bearings

"like a hawk"

until they switched to Tycol Green Cast Grease

This manufacturer had been experiencing numerous difficulties with the grease previously used on his centrifugal boiler pumps and the bearings on his chain stokers. On the advice of a Tide Water engineer they switched to Tycol Green Cast Grease. Since then the nuisance of having to keep an eagle eye on the grease job has been eliminated. Now they just put in Tycol Green Cast Grease and forget it. One less item to worry about — the grease stays put and does an economical and dependable job of lubricating.

Tycol Green Cast Grease can effect economies in your plant, too, because this modern grease is made from a paraffine base cylinder oil combined with a minimum of soap. More oil — less soap — means better lubrication.

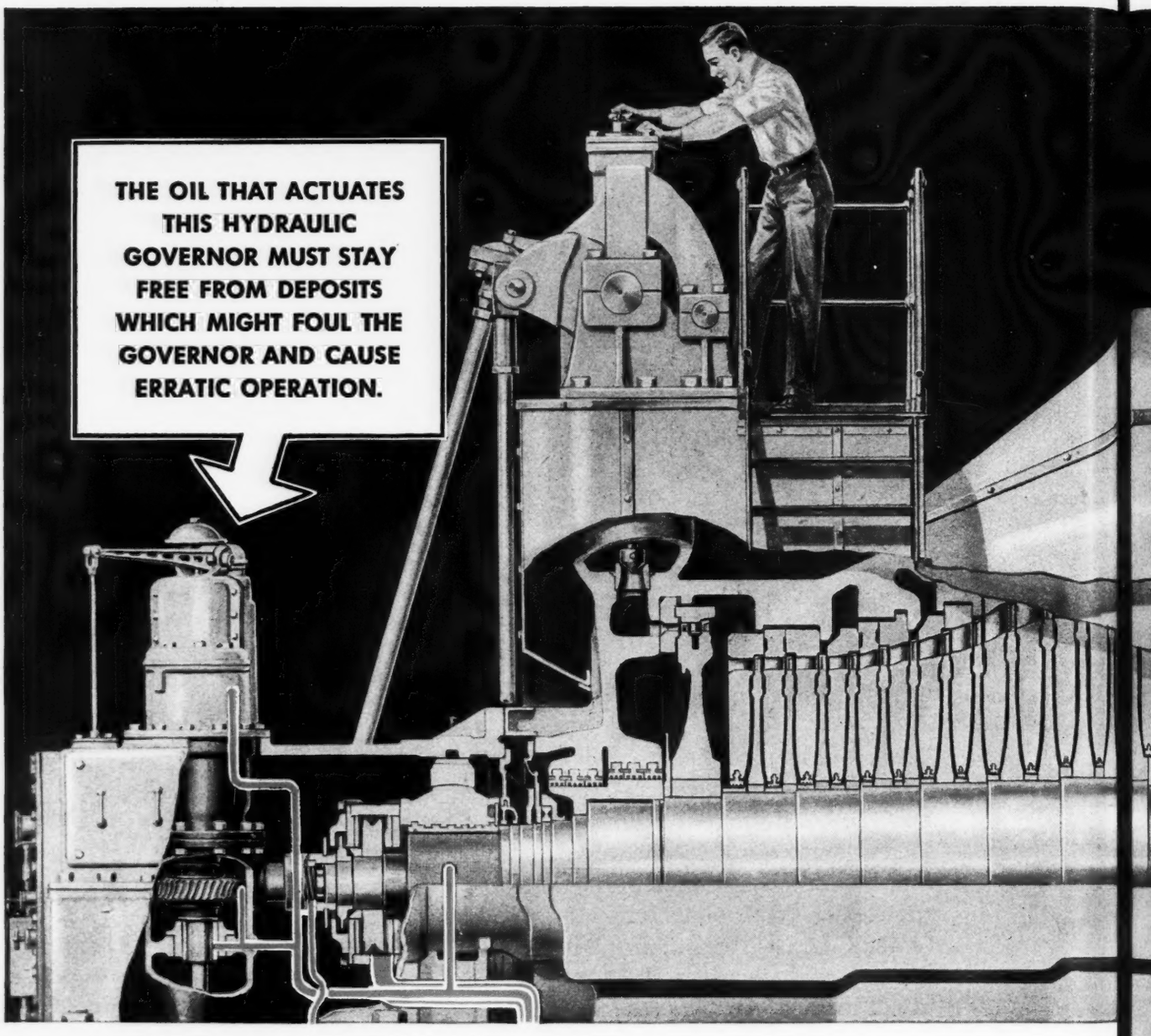
Let a Tide Water engineer show you where and how improved lubrication can step up production. Write the Tide Water Associated Oil Company, 17 Battery Place, New York, N. Y. Assistance is freely offered.

DRUMS! DRUMS! DRUMS! DRUMS!
War needs make it extremely important that all empty drums be returned immediately.

INDUSTRIAL TYCOL OILS-GREASES

TIDE WATER ASSOCIATED OIL COMPANY EASTERN DIVISION
17 Battery Place, New York
Regional Offices: Boston, Philadelphia, Pittsburgh, Charlotte, N. C.

MAKERS OF THE FAMOUS VEEDOL MOTOR OIL

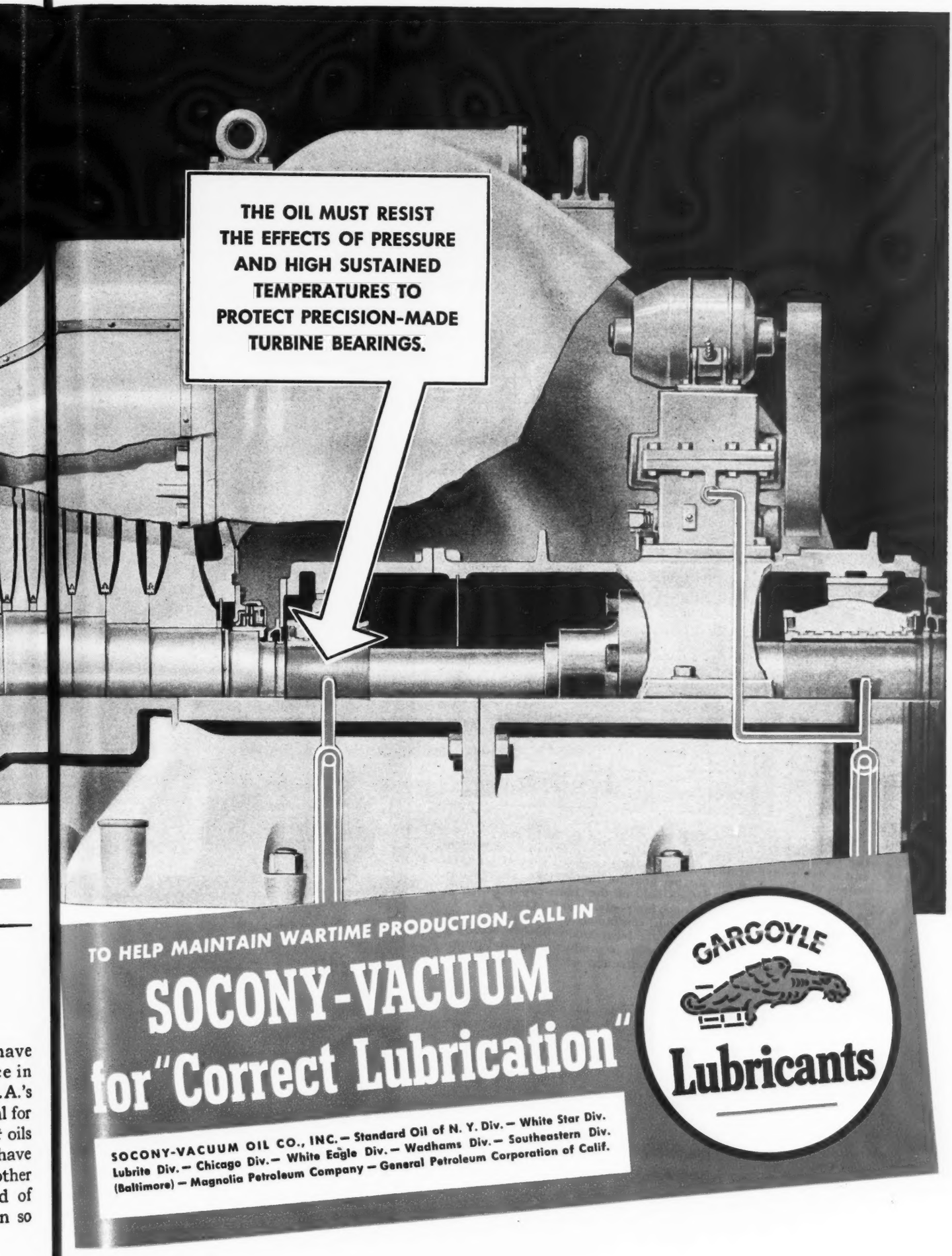

THE OIL THAT ACTUATES THIS HYDRAULIC GOVERNOR MUST STAY FREE FROM DEPOSITS WHICH MIGHT FOUL THE GOVERNOR AND CAUSE ERRATIC OPERATION.

How to Choose a Turbine Oil

READ THESE PERTINENT FACTS ABOUT THE FUNDAMENTAL JOBS A LUBRICATING OIL MUST DO:

Problem: This cutaway picture of a steam turbine shows how bearings and hydraulic governor are furnished with oil from one big circulation system. The oil must not only lubricate but also carry away large amounts of heat conducted from the extremely hot turbine steam through the shaft to the bearing. It must have the stability needed to resist oxidation and the formation of deposits which might "starve" bearings and foul the governor.

Answer: *Gargoyle D.T.E. Oils* have proved by actual service in more than 51% of the U.S.A.'s major-sized steam turbines that they are ideal for this lubrication job. These oils were the *first* oils specifically made for steam turbines. They have been constantly improved, and today, no other turbine oil can even approach the record of "D.T.E.'s" for long-term, reliable service in so great a number of steam turbines.



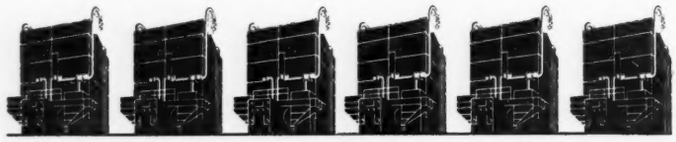
TO HELP MAINTAIN WARTIME PRODUCTION, CALL IN

SOCONY-VACUUM
for "Correct Lubrication"

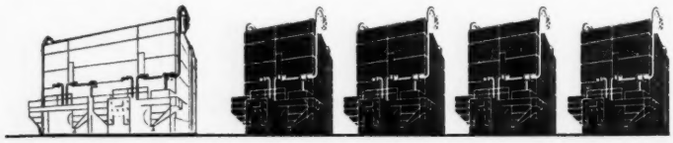
GARGOYLE
Lubricants

SOCONY-VACUUM OIL CO., INC. — Standard Oil of N. Y. Div. — White Star Div. Lubrite Div. — Chicago Div. — White Eagle Div. — Wadhams Div. — Southeastern Div. (Baltimore) — Magnolia Petroleum Company — General Petroleum Corporation of Calif.

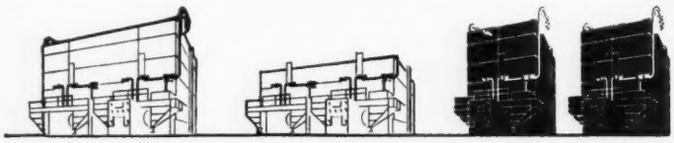
ONE boiler pinch-hits for 6 without



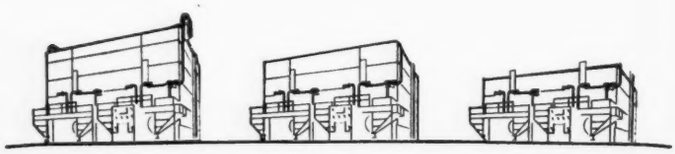
FALL 1939 A locomotive plant had coasted along for many years with six old boilers. Then war was declared and business boomed! Existing capacity proved inadequate for anticipated steam demands. A boiler replacement program was started immediately.



JULY 1940 Two old boilers scrapped and replaced by one new boiler designed for normal steam output of 25,000 lbs. per hour, about 200% rating. Hall System of Boiler Water Conditioning was employed.

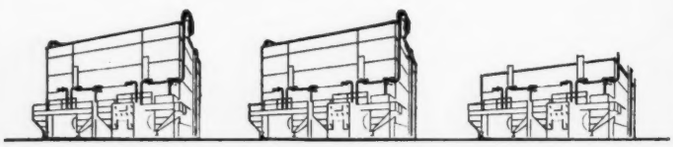


FALL 1940 New boiler No. 2 under construction — steam demands rising. Then a plant addition was started, for large-scale war production. The last two old units also had to go!

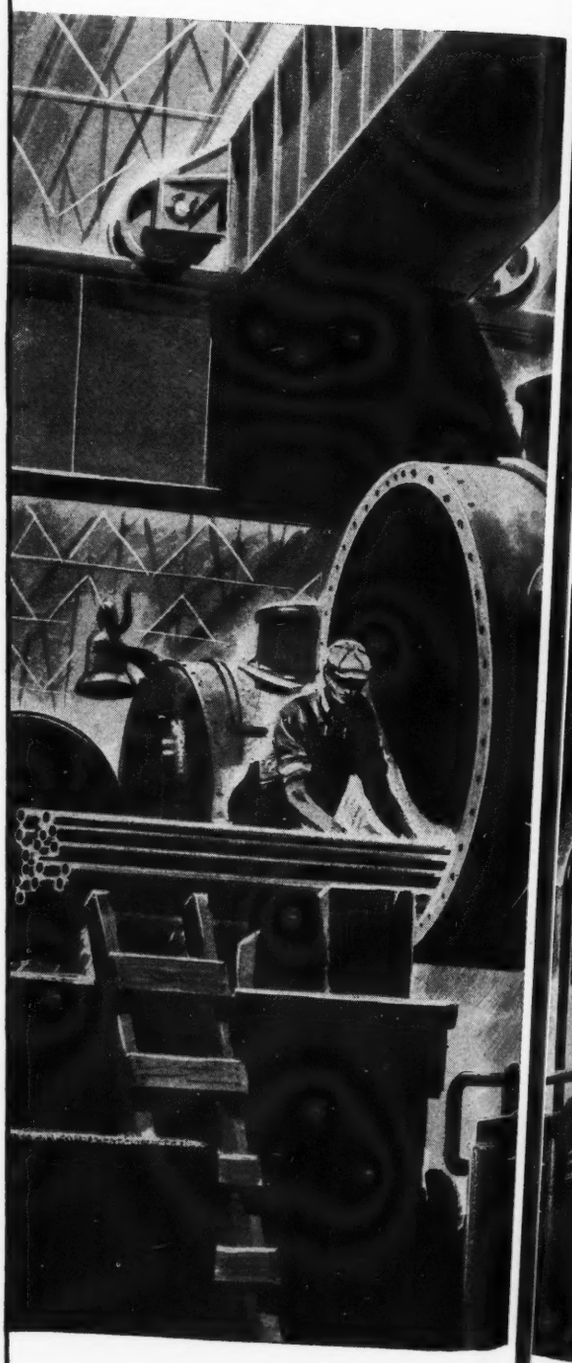


DECEMBER 1940—JANUARY 1941 New boiler No. 1 carrying entire plant load—at all-time peak due to increasing plant production and severe winter weather. Daily steam flow charts showed uniform output of 38,000 to 40,000 lbs. per hour for 16 hours. For the remaining 8-hour peak period, the pen went off the chart—production estimated in *excess* of 45,000 lbs. per hour—about *400%* rating!

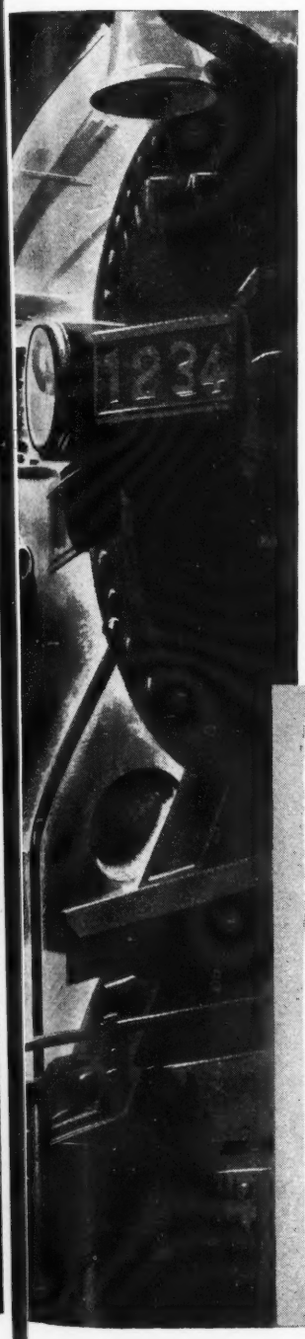
Despite these critical conditions, *continuous operation was safely maintained.* No scale, carryover, tube burn-outs or outages occurred, which would have meant serious delays in production of vital equipment and possible strangulation by freezing water lines in the extremely cold weather.



FEBRUARY 1941 Second new boiler completed, relieving heavy overload on new boiler No. 1. Soon after, new boiler No. 3 entered service. By careful application of Hall System methods, plant operators had replaced six old boilers with three new ones, met *all* steam demands, and are *now* producing at an all-time high rate!



at *400%* rating for 2 months a tube loss! ... *thanks to Hall System*



THE story on the opposite page is convincing evidence that *reliable* water conditioning is a prerequisite for continuous boiler operation at maximum capacity. And every power plant engineer is facing *that* prospect—even *you*.

Because water *won't* wait, *don't* wait for your water to tell you. Before you start racing your boilers you've got to be reasonably certain that conditions—on the water side—are reliably *right*.

What better way is there to be certain than to employ the system of *proven performance* (see facing page), developed by the pioneering leaders in scientific boiler water conditioning, and practiced by the leading power plants—on land and sea—not only in this country but all over the world?

That system is the Hall System of Boiler Water Conditioning.

There is no substitute for reliability—so play safe—and *stay* safe—with Hall System. Write or wire today!

HALL LABORATORIES, INC. · 300 ROSS STREET · PITTSBURGH, PA.

HALL SERVICE IN A NUTSHELL

At your immediate disposal are placed the technical knowledge and facilities of the pioneering leaders in scientific boiler water conditioning. In addition, with your full cooperation, Hall Service:

1. **Minimizes boiler outages caused by water.**
2. **Helps maintain highest efficiency.**
3. **Establishes non-embrittling water.**
4. **Minimizes carryover.**
5. **Prevents corrosion in boilers and associated equipment.**
6. **Prevents deposition in water lines and cooling systems.**

In trouble—
the "best bet" for correction.

Out of trouble—
the "best yet" for protection.

HALL SYSTEM
of Boiler Water Conditioning

CONSIDER THESE IRON

Fig. 1021

"Ferrenewo" Globe Valve
150 lb. S. P.

Fig. 1640

"King-clip" Gate Valve
150 lb. S. P.

LUNKENHEIMER V

BODY VALVES TO SAVE BRONZE

THE "KING-CLIP" – a husky iron body gate valve which employs bronze for the internal working parts only. For many services, the "King-clip" will serve equally as well as a bronze gate valve. Easily taken apart for cleaning. A valve that withstands hard and continuous usage.

THE "FERRENEWO" – an iron body globe valve that may be used instead of bronze valves for many services. All internal parts are made of non-corrodible alloys and are renewable. Seat and disc are regrindable. The "Ferrenewo" will give excellent service with negligible upkeep cost.

Investigate the adaptability of these iron body valves to your needs.

ESTABLISHED 1862

THE LUNKENHEIMER CO.

"QUALITY"

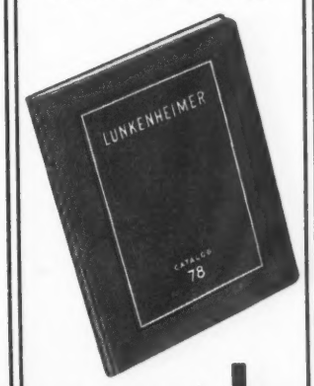
CINCINNATI, OHIO. U. S. A.

NEW YORK CHICAGO
BOSTON PHILADELPHIA

EXPORT DEPT. 318-322 HUDSON ST., NEW YORK

Since virtually all materials used in the manufacture of valves are on the list of critical materials, valve users are urged to furnish the highest possible preference ratings on their orders. This will be of mutual helpfulness.

Your Lunkenheimer distributor has a supply of Catalog 78. Ask for your copy.



VALVES BOILER MOUNTINGS LUBRICATING DEVICES

28-94-42

New Pump ...offers 5 big Improvements!

New Allis-Chalmers Electrifugal "One Package" Pump is 5-Way Winner in Helping You Meet Wartime Industrial Pumping Needs!

NEW in design . . . NEW in construction — Allis-Chalmers Electrifugal Pumps give you a NEW type of pumping performance . . . to meet the most exacting requirements of war industry.

With this compact, sturdily-mounted pump-and-motor unit, you save up to 33% in space, reduce pump overhang as much as 40%. Unified "Tri-fit" construction, too, results in fewer section fits, fewer parts to wear, more positive shaft alignment. All this means smoother-running, longer-lasting, vibration-free operation.

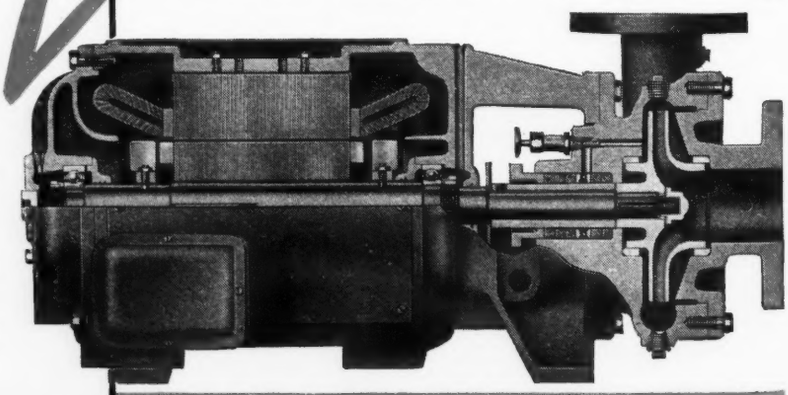
Too — the motor is new . . . 100% designed for pump use . . . and completely splash-proof. Cast bronze protective sleeves, easy-to-get-at casing, indestructible rotor, distortionless stator are other features you'll like.

So — if it's pumps you need . . . and if you want to get better pumping with as much as 33% saving in initial costs over conventional pump installations — use this 5-way winner . . . in sizes from ½ hp to 25 hp.

For the whole story, call the district office near you. Or write Allis-Chalmers, Milwaukee, Wisconsin. A 1495

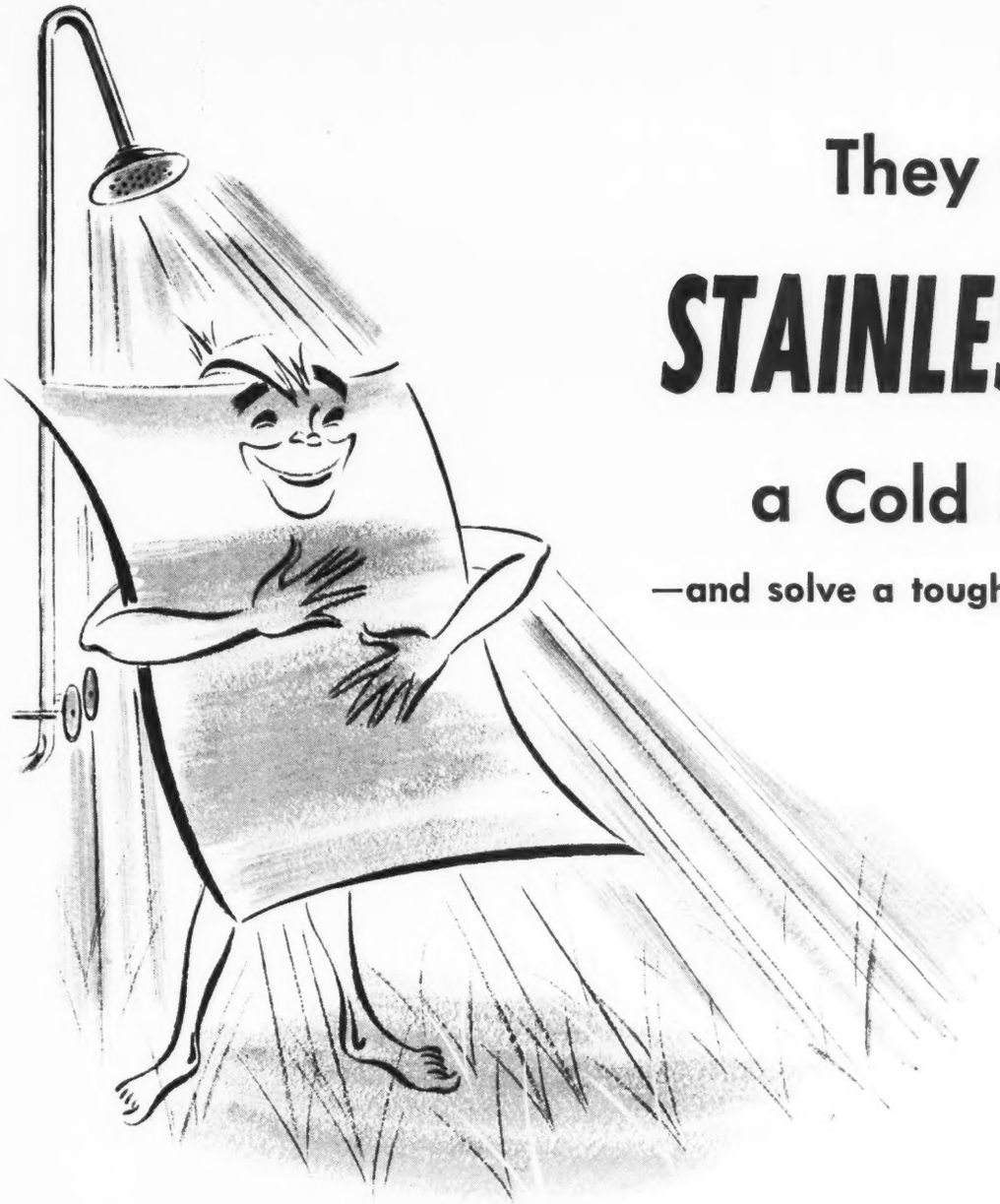
CHECK These Great One-Package Features:

1. *Up to 33% Space Saved* with one frame, one solid driving shaft construction.
2. *Overhang Cut As Much as 40%.* Four solid supports assure precision balance . . . ease strain on vital parts.
3. *New Tri-Fit Design* eliminates 2 section fits for more positive shaft alignment, wearless and vibration-free performance.
4. *Splash-Proof* Motor standard equipment . . . 100% designed for pumping.
5. *Easy-to-Get-at* Casing simplifies stuffing box and waterseal gland inspection.



Allis-Chalmers Pumps Can Cut Your Pumping Costs

ALLIS-CHALMERS
MILWAUKEE · WISCONSIN



They Give STAINLESS STEEL a Cold Shower

—and solve a tough corrosion problem

IN equipment for handling dilute sulfuric acid, tests under operating conditions indicated that 18-8 Stainless Steel containing molybdenum would give satisfactory service life under the highly corrosive conditions. The corrosion resistance and high strength of this material permitted engineers to use a new and more efficient design. When plant operations began, it was found that even this highly-resistant steel was being corroded in a few spots. Electro Metallurgical Company engineers were asked to solve the problem.

Inspection showed that due to increased temperature of certain parts of the equipment above the liquid level the dilute acid was being concentrated. This concentrated acid combined with higher temperatures produced the corrosion. The solution to the problem was a water spray on the affected areas to prevent temperature rise and subsequent acid concentration.

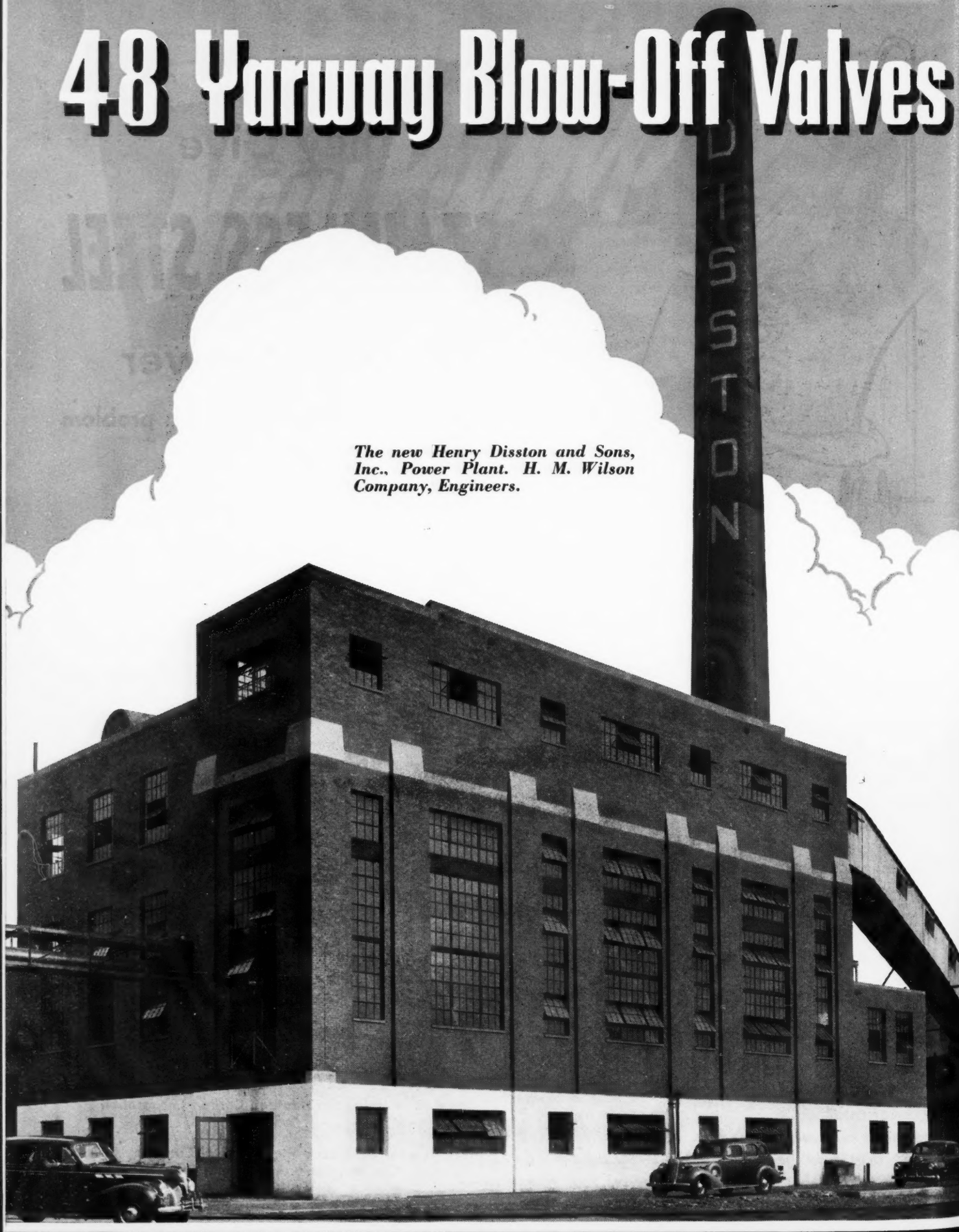
In stainless steel equipment handling dilute acids or acidic vapors, it is important that acids are not allowed to concentrate where they may cause corrosion. Periodic inspection of your stainless steel equipment, especially stacks and flues, will show whether you have such a corrosion problem in your plant.

Although we do not make steel, we have for more than 35 years produced "Electromet" ferro-alloys used in the making of steel. With the knowledge accumulated from this experience we are in a position to give impartial advice on the selection and use of stainless steels. If you have a specific problem in the use, maintenance, or fabrication of stainless steel, consult us.

ELECTRO METALLURGICAL COMPANY
Unit of Union Carbide and Carbon Corporation
30 East 42nd Street UCC New York, N. Y.
In Canada: Electro Metallurgical Company of Canada, Limited, Welland, Ontario

Electromet
Trade-Mark
Ferro-Alloys & Metals

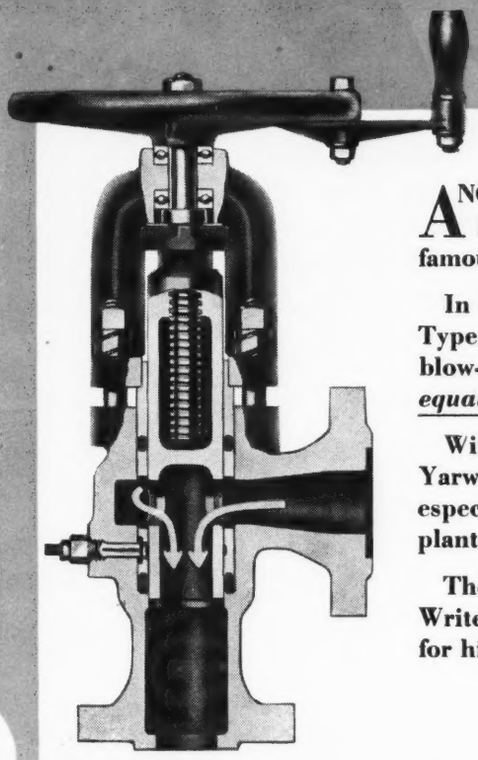
48 Yarway Blow-Off Valves



The new Henry Disston and Sons, Inc., Power Plant. H. M. Wilson Company, Engineers.

YARWAY

Serve New Disston Power Plant



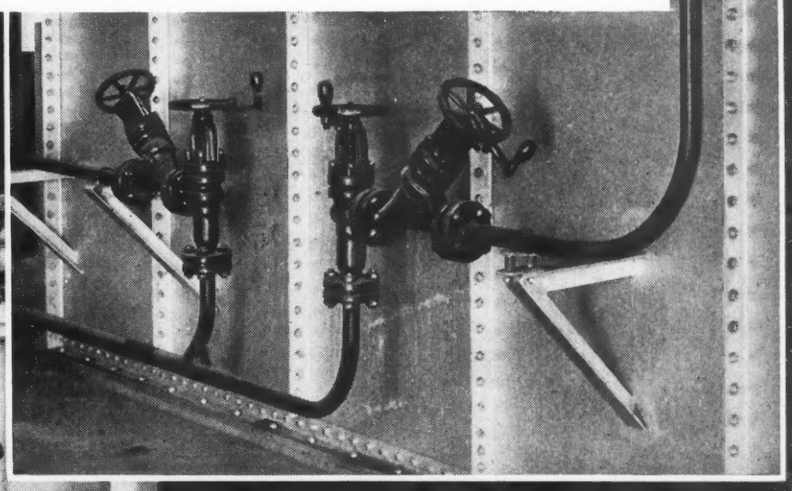
ANOTHER prominent industrial plant selects Yarway Seatless Blow-Off Valves—Henry Disston & Sons, Inc., Philadelphia, famous one-hundred-and-two-year-old saw, file and steel maker.

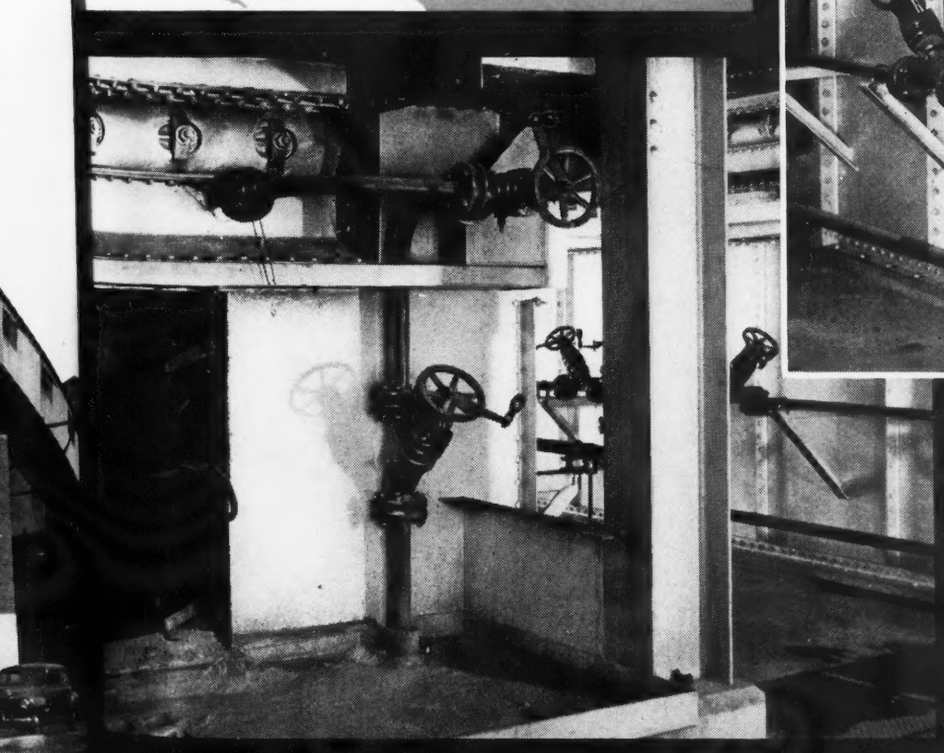
In this modern 600 lb per sq. in. pressure steam plant, 24 Yarway Type C Seatless Tandem Blow-Off Valves are in use—six on main boiler blow-down lines and eighteen on water-wall drains. *This tandem is equally suitable for blowing or draining and sealing.*

With "no seat to score, wear and clog with scale and dirt," the Yarway Seatless design is the most widely preferred blow-off valve—especially today, when the utmost in efficiency is demanded of all plant facilities.

There is a Yarway Valve for every pressure, purse and purpose. Write for Catalog B-421 for pressures up to 400 lbs. Catalog B-431 for higher pressures.

YARNALL-WARING COMPANY
100 Mermaid Ave., Philadelphia





Above: Two of the 18 Yarway Seatless Tandem Blow-Off Valves in use on water-wall drains.

Left: Typical view of Yarway Seatless Blow-Off Valves on Main Boiler Blow-down Lines. Equally suitable for blowing or draining and sealing.

BLOW-OFF VALVES

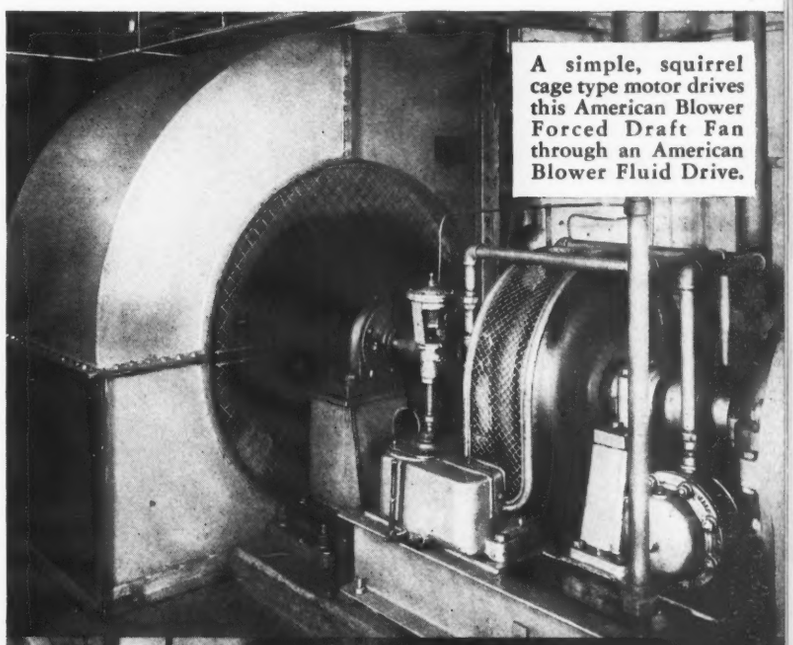
In Springfield

Ohio Edison Company's Mad River electric generating station. In circle, upper right, the Company's modern Springfield, Ohio, headquarters.

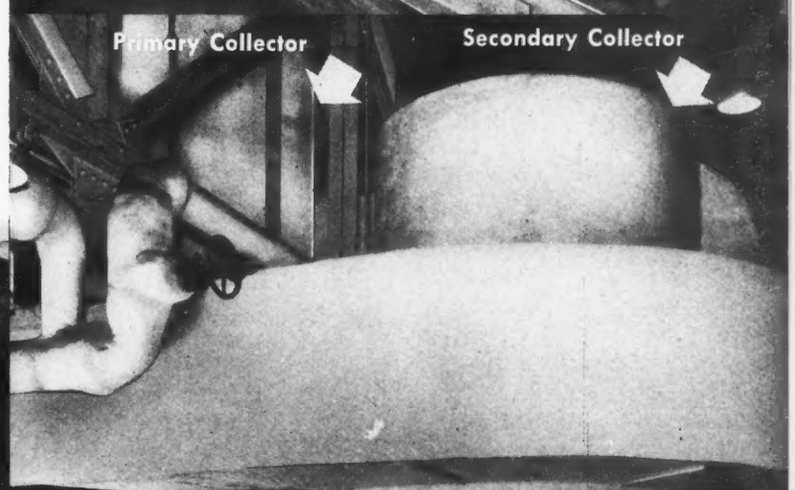
OHIO EDISON

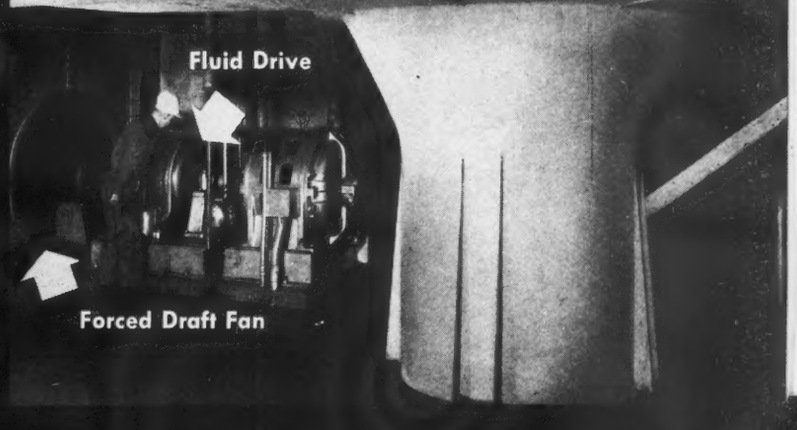
paces production

Springfield's early industries—woolen, cotton, flour and powder mills — were important factors in the rapid development of central Ohio. Water power from Lagonda Creek and Mad River turned the wheels, paced production. New generations expanded old industries, brought new; set up new standards of efficiency and speed. Now, electric power — abundant, dependable and cheap—paces production. The Ohio Edison Company is keenly aware of its community's dependence upon it—not only by the scores of industries "all-out for Victory," but by civic, commercial and rural customers, all working toward the same goal. We are proud that American Blower Forced and Induced Draft Fans, Fluid Drives and Dust Precipitators were selected by the Ohio Edison management in their foresighted planning of electric generating facilities to meet today's emergency requirements. May we have the privilege of serving you?



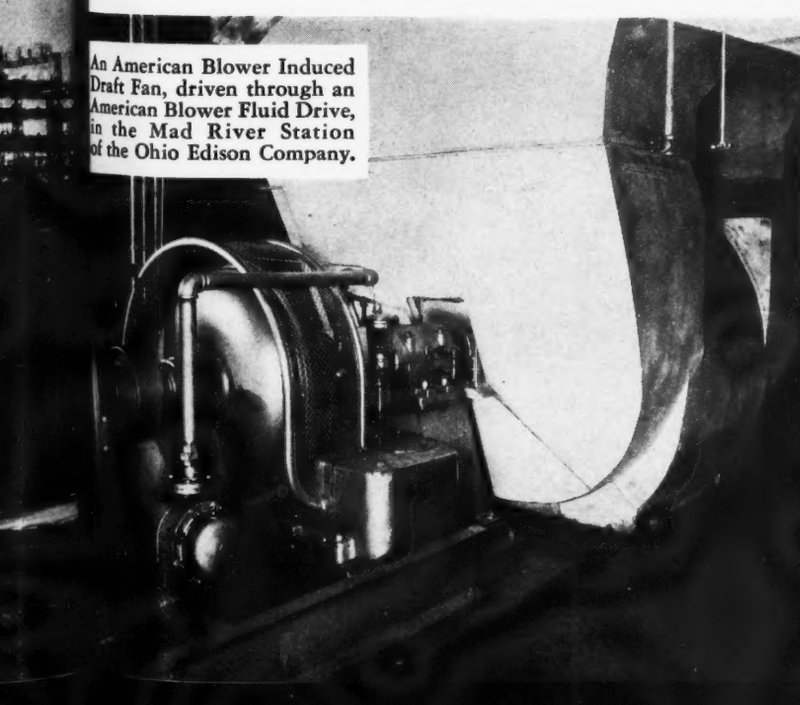
A simple, squirrel cage type motor drives this American Blower Forced Draft Fan through an American Blower Fluid Drive.





AMERICAN BLOWER

AMERICAN BLOWER CORPORATION, DETROIT, MICH.
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONT.
Division of AMERICAN Radiator and "Standard" Sanitary Corporation

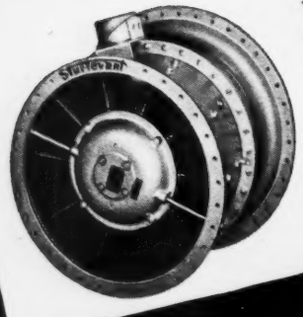


An American Blower Induced Draft Fan, driven through an American Blower Fluid Drive, in the Mad River Station of the Ohio Edison Company.

the FAN *of tomorrow–*

Here are the
Outstanding Advantages:

UNIFORM DUCT VELOCITIES



The ingenious STREAM-VANES, shown on the discharge end, straighten out the tornado-like spin that comes from the wheel, insure equal flow and uniform velocity throughout the duct area. This means higher system efficiency, less overall resistance.

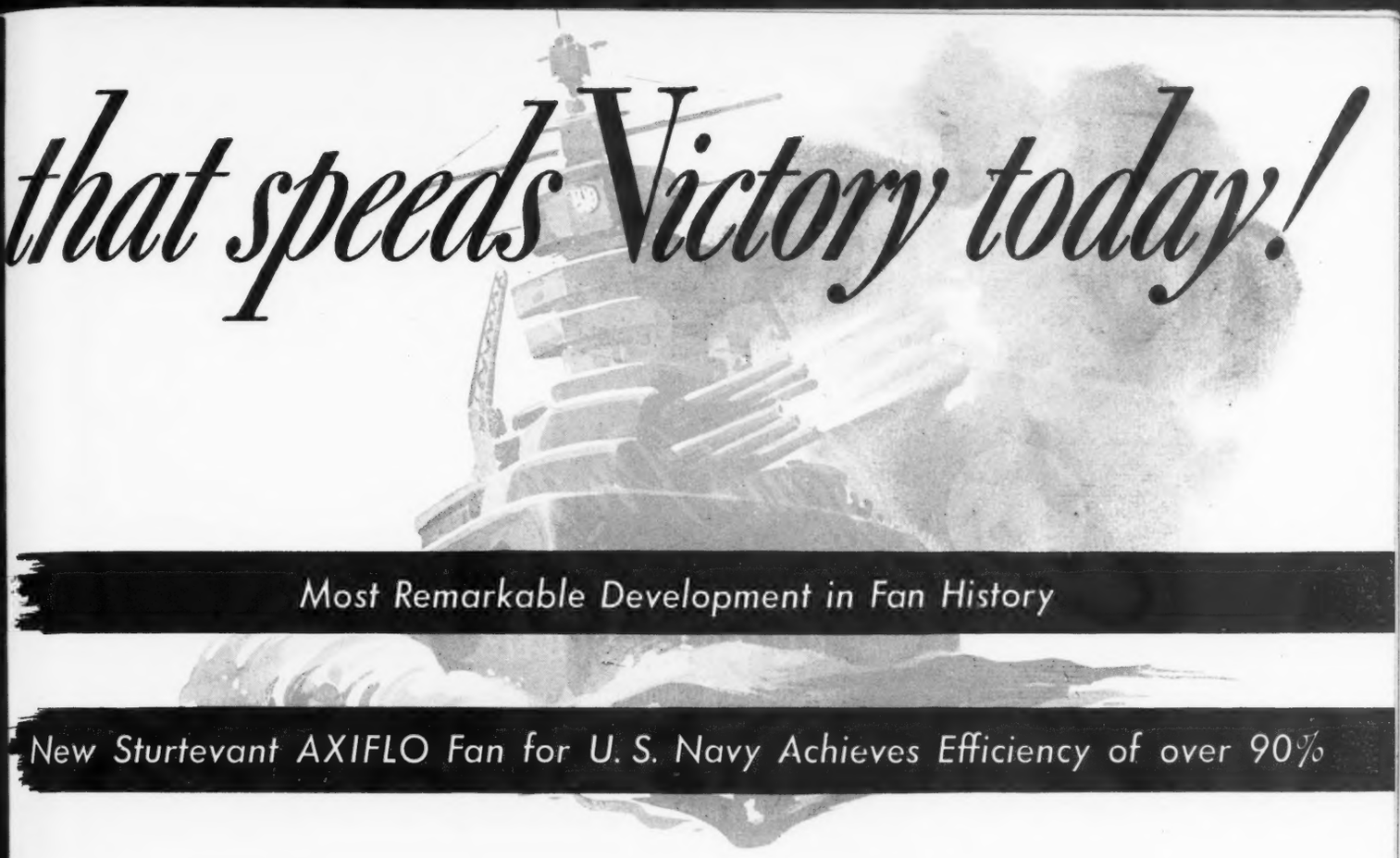
EXTREMELY QUIET

Due to the elimination of turbulence, the new Sturtevant Axiflo Fans are extremely quiet in operation. For example, one fan handling 12,000 cfm at 3" static pressure, 1750 rpm, recorded only 79 decibels —well within the range of acceptable noise levels.

BIG SAVING IN SPACE

The unit is extremely compact for the volume of air handled. It generally occupies only 60% of the space required for other fan designs of comparable capacities.

that speeds Victory today!



Most Remarkable Development in Fan History

New Sturtevant AXIFLO Fan for U. S. Navy Achieves Efficiency of over 90%

STURTEVANT RESEARCH TRIUMPHS AGAIN! This time with the most revolutionary and far-reaching fan achievement of the age. An Axiflo Pressure Fan developed after years of Sturtevant Research and now utilized for the first time by the U. S. Navy.

Get a quick picture of the new Sturtevant Axiflo fan from the high-spotted features below. See how it makes an axial flow fan available for an entirely new field of high duty requirements. A fan ideally adapted for heating, ventilating, air conditioning and mechanical draft applications . . . with all the advantages listed below.

This fan, in its highest stage of development, is being supplied for hull ventilation and mechanical draft in U.S. Warships exclusively—and must remain so for the duration. However, an adaptation of this design in all steel construction, with efficiencies approaching this new fan, is going to work on war production—drying vital materials, removing dust and fumes from manufacturing operations, speeding the victory program in countless ways.

Write for a copy of Bulletin No. 460, illustrating various designs, construction features, efficiency and noise curves of this extraordinary new development in fan engineering.

B. F. STURTEVANT COMPANY
Hyde Park, Boston, Mass. *Branches in 40 Cities*
B. F. Sturtevant Company of Canada, Ltd., Galt, Toronto, Montreal

FLAT HORSEPOWER CHARACTERISTIC

A relatively flat horsepower curve is achieved over the entire range of the fan, without sacrificing an increase in pressure at reduced volumes.

HIGH ROTATIVE SPEED

Two standard speeds (1160 and 1750 rpm) for all sizes permit the use of standard high speed motors—a saving both in weight and cost. Still higher speeds are possible with turbine drive.

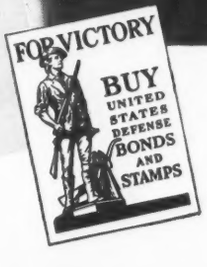
PRESSURES UP TO 60" w.g.

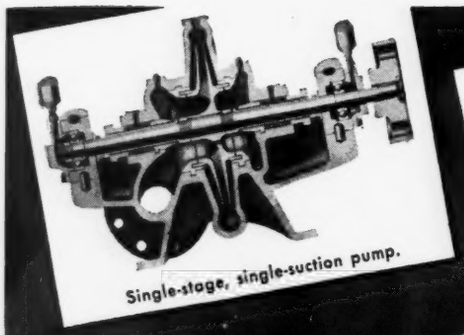
These fans handle large volumes of air with extraordinary efficiencies, against a wide range of pressures. Some designs operate against static pressures as high as 60" water gauge.

Sturtevant
REG. U.S. PAT. OFF.

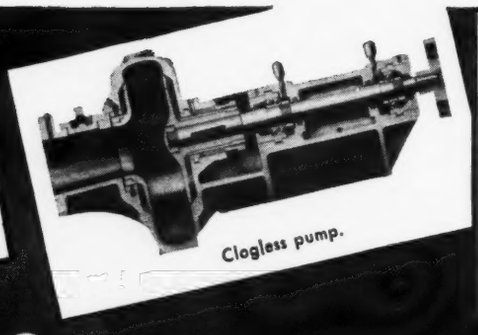
Puts Air to Work

STURTEVANT—
FOUNDER OF THE
AIR HANDLING
INDUSTRY

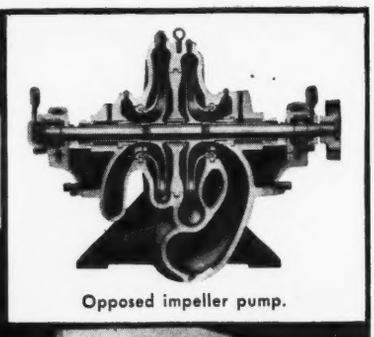




Single-stage, single-suction pump.



Clogless pump.



Opposed impeller pump.

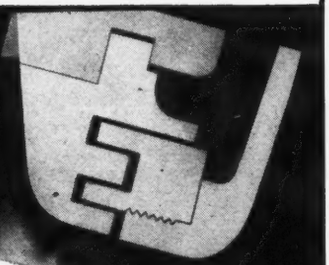
40 Year's Progress

IN CENTRIFUGAL PUMP DESIGN

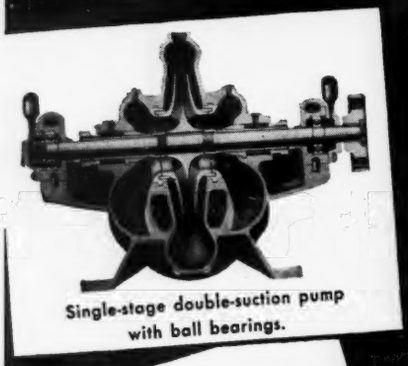
The modern-style, high quality centrifugal pump for motor and turbine speeds, with horizontally split casing, LABYRINTH WEARING RINGS, and removable wearing parts, was introduced by the De Laval Steam Turbine Company in the year 1901.

Advanced methods and equipment for interchangeable manufacture, including jigs, special machine tools and limit gages, were at the same time provided to make possible accurate and high-quality production.

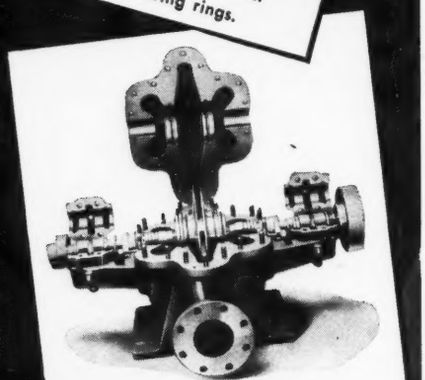
The De Laval Engineering Department has concentrated continuously during 40 years upon the problems of centrifugal pump design and application. This specialization places at the user's command a complete, modern line of highest quality pumps and a vast store of knowledge and unsurpassed expertness in solving pumping problems. State conditions of use and ask for Publication P-3223.



Renewable labyrinth wearing rings.

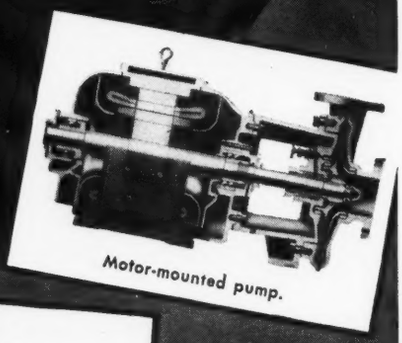


Single-stage double-suction pump with ball bearings.

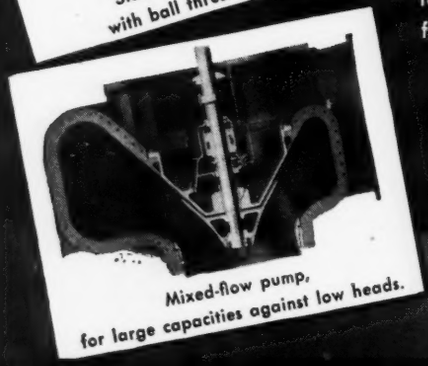


Sleeve-bearing pump opened for inspection.

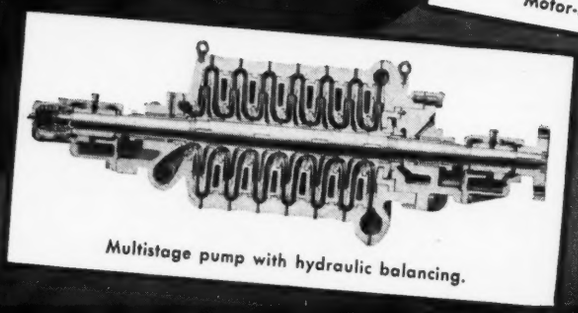
Sleeve-bearing pump with ball thrust bearing.



Motor-mounted pump.



Mixed-flow pump, for large capacities against low heads.



Multistage pump with hydraulic balancing.

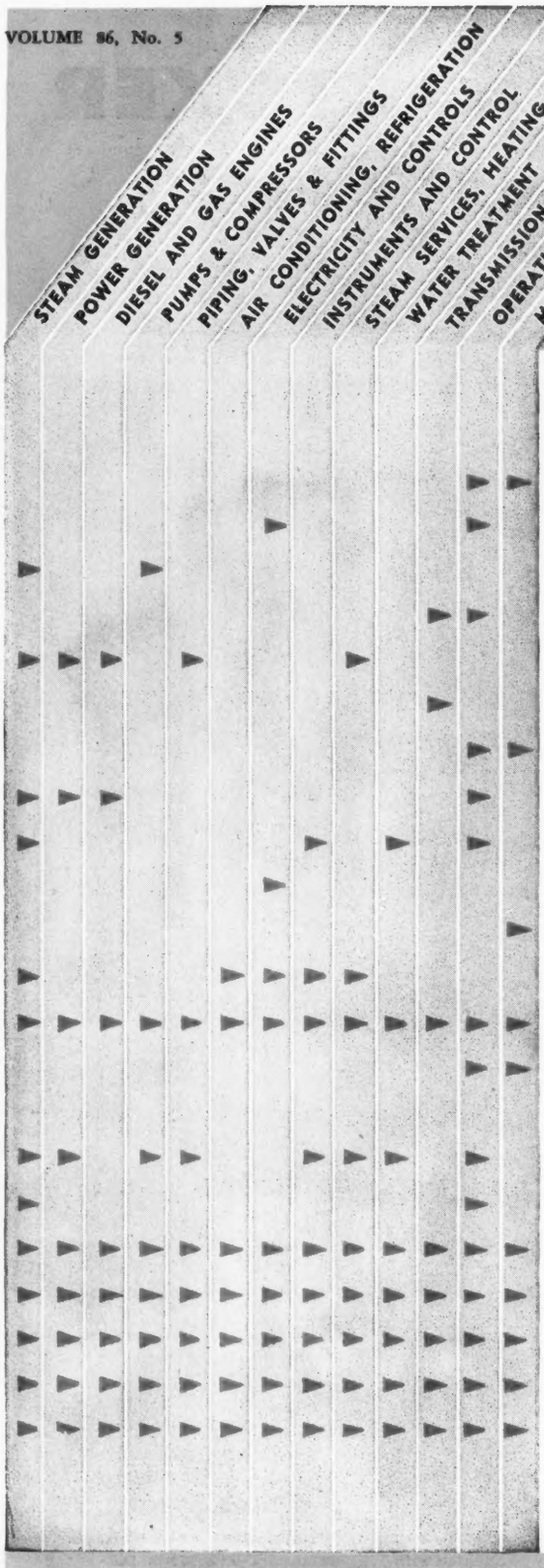
HYDRAULIC INSTITUTE USA MEMBER

DE LAVAL Steam Turbine Co.

TRENTON, N.J.

MANUFACTURERS OF TURBINES STEAM, HYDRAULIC PUMPS CENTRIFUGAL PROPELLER ROTARY DISPLACEMENT MOTOR-MOUNTED MIXED-FLOW CLOGLESS SELF PRIMING CENTRIFUGAL BLOWERS and COMPRESSORS, GEARS WORM, HELICAL and FLEXIBLE COUPLINGS

VOLUME 86, No. 5



POWER

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MAY, 1942

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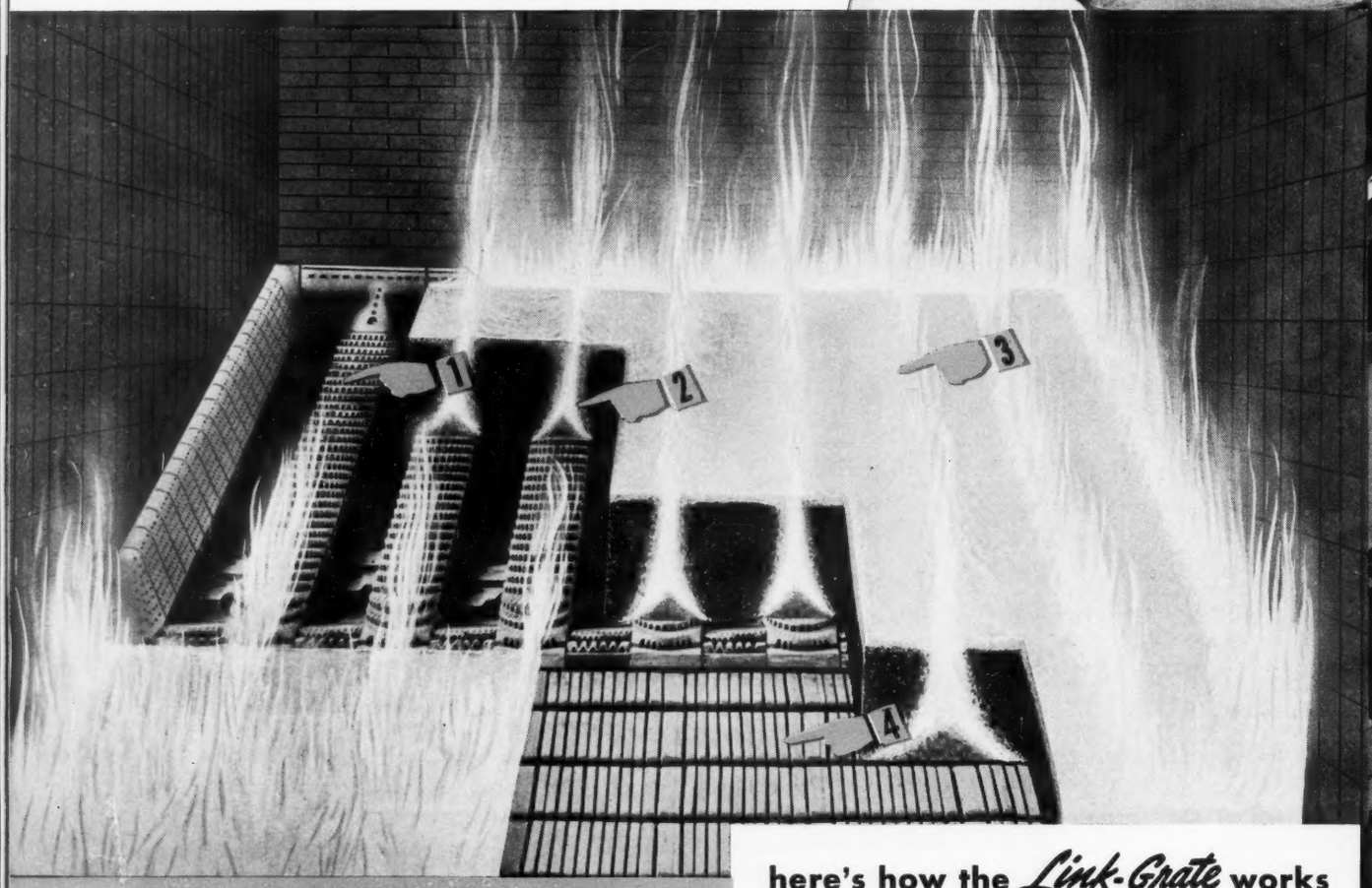
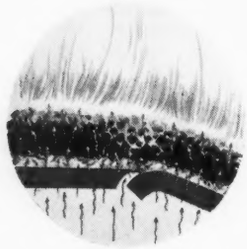
Link-Grate STOKER



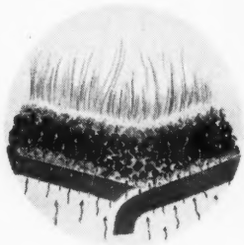
Tuyere design **1** diffuses the air, making it possible to admit large volumes of air at low pressures. Burning lanes are kept open **2.** Coordinated results of positive ram action, efficient air admission and Link-Grate motion promote combustion over the entire grate area **3** without matted fires or thin spots. Link-Grate motion **4** processes the fuel bed and conveys it continuously rearward.

here's how the *Link-Grate* works



grates up

Fuel bed opened and thoroughly permeated with low-pressure air. Fused ash oxidized, clinkers broken into small, friable pieces.



grates down

Fuel bed cracked, crumbled and made porous for uniform flow of gases throughout entire combustion area.

Complete cycle of Link-Grate operation keeps grates cool and conveys fuel bed rearward.

"are you getting this kind of performance from your stokers?"

time-saver for industry

Here's why *Link-Grate* Stokers save time

no periodic dumping

Continuous ash discharge is a fact, not a theory, in Link-Grate stokers. With every cycle of the Link-Grate motion, there is a positive conveying movement of the fuel bed rearward, and ash is ejected off the ash discharge plate. There is no need for periodic dumping; therefore, steam pressure is maintained constantly under varying load demands. There are no periods of low steam pressure while fire is dumped and brought back to full fuel burning capacity. No lost production from low steam pressure.

no periodic barring or hooking

Controlled, continuous motion of the Link-Grate keeps fuel beds porous, keeps burning lanes open. Consequently, there's no need for periodic barring and hooking. Reduction in manual labor enables operators to obtain maximum results from more boilers. Operating by adjustments and instruments—not by bar and hook.

fewer shutdowns

Air is admitted at low pressures, and is so diffused as to keep grates cool while thoroughly permeating the fuel bed. Because the entire fuel bed is kept porous, resistance to air pressure is uniform and there is little tendency to blow through. Continuous service periods of 6 to 12 months without shutdown are common with Link-Grate stokers.

no time lost using "attica iron" parts

Factory-made parts are interchangeable. Castings subject to heat of furnace are small; are quickly and easily replaced. Time off the line is reduced to a minimum.

J-50410

SAVINGS IN TIME required for operation and maintenance is only one of many factors contributing to Link-Grate efficiency. Ask your Westinghouse representative to show you a Link-Grate stoker in service. These interesting fact-books also answer your questions on High Availability, Fuel Flexibility, Safety, Ability to Meet Changing Steam Demands. Bulletin 3039 (multiple retort), Booklet 2196-A (single retort). Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., Dept. 7-N.

Westinghouse

RADIANT HEATING IS HELPING PLANTS TO MEET AN EMERGENCY

★ ★ ★

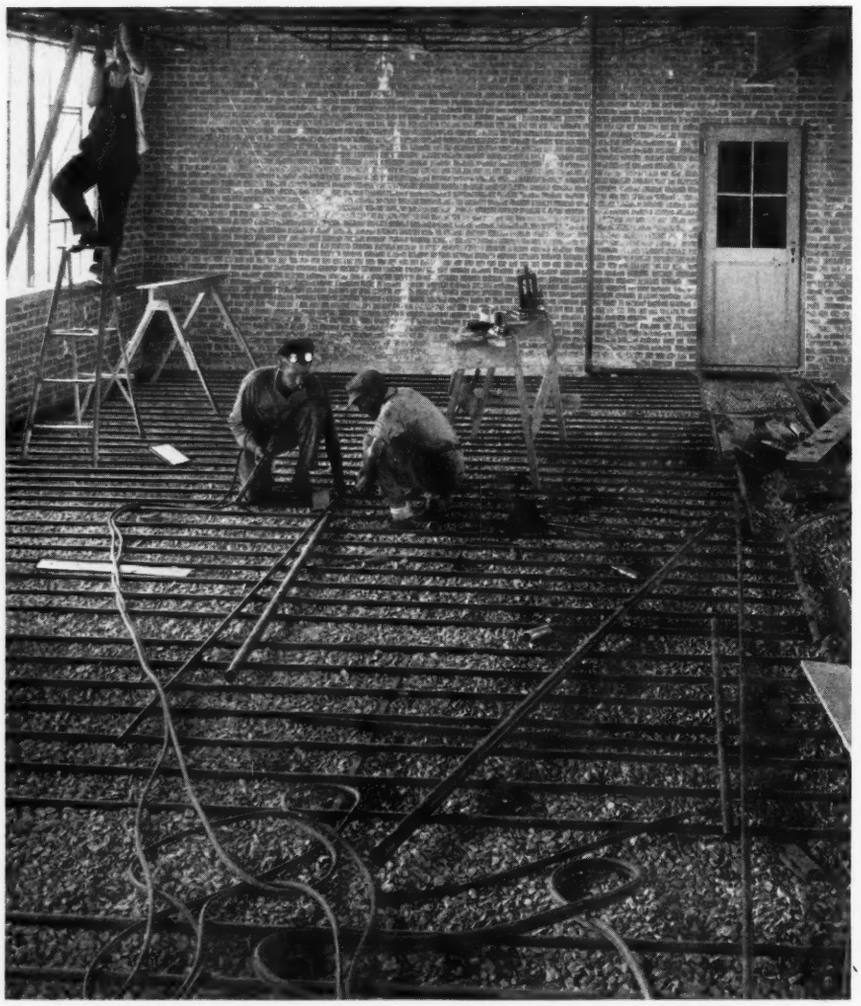
BYERS

WROUGHT IRON

Heating for new industrial buildings is causing a lot of headaches for plant engineers today. Some equipment ordinarily used is no longer available. Certain available types demand extravagant tonnages of critical materials. As a result, many plantmen are giving renewed thought to Radiant Heating, as the best means of getting first-class heating results, and at the same time saving metal the Nation so badly needs.

The savings possibilities are illustrated by a comparative check recently made. It covers a small structure, but illustrates the point. Radiant heating required 930′ of ¾″ pipe—a total weight of 850 lbs. A conventional hot water system of equivalent capacity would require 1700 lbs. of metal, while an equivalent 2-pipe steam system would demand 1200 lbs. (All these figures are exclusive of weight of boiler.)

Industry is well represented in the 400-plus Radiant Heating installations now serving, and results are highly encouraging. A New York concern reports 30 years of satisfactory service from a floor-type job. After several years experience, a Wisconsin Company writes, "We are well satisfied with its (Radiant Heating) operation from all angles." A Steel and Foundry Company official calls their Radiant Heated Building, "the most comfortable we have ever worked in," and says fuel consumption was ⅓ that estimated for a conventional system. Installations have been or are being made, or are on the boards, in Illinois, Michigan, Ohio and Maryland plants.



The speed and simplicity of installation of Radiant Heating is suggested by this progress picture in the administration building of a steel and foundry company. The wrought iron pipe, fabricated into grids, was placed on the gravel bed, and joined with a few field welds. Another layer of gravel was then applied, and the concrete topping poured. Setting and connecting the boiler completes the job.

You will recognize that the nature of the service requires an unusual combination of corrosion resistance, thermal properties, and ease of fabrication in the piping materials used. Actual field service records under identical conditions, and covering periods of many years, have demonstrated wrought iron's claim to these essential properties, and your own experience will confirm it.

Our 48-page technical bulletin, "Byers Wrought Iron for Radiant Heating Installations," is filled with helpful information on design and installation. If you want additional assistance, we will put you in touch with some of the many engineers who have first-hand experience with Radiant Heating in all its phases.

A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Chicago, St. Louis, Houston, Seattle, San Francisco.

Corrosion costs you more than Wrought Iron

BYERS GENUINE WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

STEEL TUBULAR PRODUCTS

POWER

Established 1882 • PHILIP W SWAIN, Editor

How to Fight the Fire Bomb

Part Two of this May number of POWER is a large wall chart titled "How to Fight the Fire Bomb." As far as we know this is the first time in America that complete authentic instructions for extinguishing incendiary bombs have been printed in this form with adequate photographic illustrations.

With the appreciated cooperation of the Safety Research Institute, POWER's editors staged and photographed this procedure for extinguishing incendiary-bomb fires. The final presentation has been inspected and approved by the Office of Civilian Defense.

As we see it, this chart will serve the power-engineer reader in his double role of engineering manager on the one hand and community leader on the other.

The engineers managing utility or industrial power plants are duty bound to protect such plants against every potential danger, including fire bombs. In addition, the industrial power engineer will certainly be assigned a major responsibility in any general scheme of factory fire protection, because his men supply the fire-fighting water and chemicals and know the proper use of lines, switches and valves throughout the establishment. In all these plant-protection activities the chart has a place.

Yet there is no good reason why its use should be restricted to the plant. The steps to be taken to extinguish the incendiary in the factory apply just as well if the bomb happens to fall on a church, a school or a home. Thousands of power engineers are already members of community groups organized to study and execute air-raid protection. As men of action, and long-time students of combustion, these engineers have an exceptional opportunity to help harness the community enthusiasm to practical ends. The chart can serve well for such uses because the pictures are large, the instructions non-technical and the whole procedure certified by competent authorities.

In conclusion we should recognize the simple fact that the experts do not agree as to the danger of bombing on these shores. Some think it great. Others say it is imaginary. We incline to the majority view that violent bombing is unlikely but that "token" bombings, chiefly with incendiaries, are probable.

Without taking any alarmist position, we consider aid-raid protection against incendiary bombs to be a matter sufficiently important to command the attention of responsible power engineers.

Fortunately, firefighting equipment approved for plant protection against peacetime hazards is equally suitable for fire-bomb fighting, so no great additional investment is required. More important, the job can be done without draining our supplies of strategic materials.

What is needed is the KNOW HOW; the engineer and his crew should decide right now how they will protect plant and people if Axis arsonists should choose to fly over and drop a few "eggs."

Alloy meter magnets find their way to a corner of the storage yard so that their special-metal content can be reused to best advantage. Condenser tubes, stoker castings and pump shafts that have alloy content should be segregated and labeled

YOUR JUNK

By S A TUCKER
Associate Editor

▶ ONLY IN WAR COULD WASTEFUL AMERica be persuaded to shake out its figurative wastebaskets to rescue strategic materials that would otherwise rust in dormant scrap piles or vanish into dark cellar corners. The *actual worth* of a bronze valve on the stockroom shelf, a length of copper wire, or a burned stoker casting is no longer measured in terms of "cost price," "estimated salvage" or "scrap." Materials are now worth just what they can contribute to war production.

By making best use of the materials and fabricated parts now available and by uncovering *extra* scrap sources, every power engineer on the home front can make an actual, definite, and immediate contribution to war production. Some steel furnaces are already curtailing production, others must follow shortly, for lack of scrap. "Getting in the Scrap" means "Don't throw away anything but dirt."

In 1939, America's 125,000 junkmen collected and sold to 14,000 waste dealers over 70 million pounds of aluminum, over two million tons of iron and steel, enough tin to babbitt 150,000 airplane-engine bearings and rubber enough for twelve million tires. For 1942, however, these normal scrap sources can't supply enough rusty iron to keep furnaces at capacity—mills can't make good open-hearth steel without 25% or more scrap. We also lack non-ferrous metals, alloys, rubber, burlap, paper, woolens and cotton rags.

The Bureau of Industrial Conservation, War Production Board, is speeding up collection of valuable waste materials from household attics and cellars as well as from industrial and manufacturing plants. They estimate a need for *six million tons additional* iron and steel scrap in 1942 over the expected normal source of supply. One group unfreezes legal tangles of abandoned railroads to get rails and bridges. Another tackles factories, mines, refineries, utilities, power plants.

These men are intent on uncovering scrap. Their single object is to get people to turn valuable materials back into production channels by selling unused parts or rejected waste to local dealers organized to handle scrap properly and expeditiously. Their present program has the active cooperation of 183 trade associations reaching about 30,000 plants.

During February and March, industrial establishments turned in scrap at a rate of 70,000 tons per month, most of it additional to normal returns. A paper mill "mined" 1800 tons of steel. A steel plant produced 40 tons of paper. One coal mine sent up a carload of iron a day for twenty days.

Other instances of all-out housecleaning for scrap demonstrate what can be done even where efficient salvage methods have been normal practice. The General Electric Co, for example, reports that appointing special men to survey nine separate plants resulted in uncovering *six thousand tons* of dormant metals that would otherwise not have been returned to waste dealers and armament production. Of this, they add, about 90% will go to steel mills and the remainder is composed of brass, bronze, alloys, etc.

When Goodyear Tire & Rubber Co asked its foremen to "stop holding on to things," in a plant that had conscientiously kept scrap moving as a matter of good housekeeping, they collected 3,216,000 lb of iron and steel from old molds, obsolete machinery and the like in the space of a single week. Of course no one plant can keep up such a pace for long, but a few pounds from each of many thousands of plants will snowball to considerable tonnage.

In wide-awake Erie (Pa.) the Manufacturers Association got together with the Foremen's group to talk things over with the waste dealers. They organized committees to salvage usable machines and materials for swaps with other plants, expedited collection and sale of scrap, supplied speakers, posters and "how-to" literature. The first two weeks uncovered a total of 2292 tons of *additional* scrap, a flow which has continued since. Now Erie has a salvage official in every plant and a special representative for each type of scrap. Goal for 1942 is 10–15% over normal tonnage.*

Utilities, actively organized for direct cooperation with the WPB conservation group, have already instituted a high-pressure program. A Kansas company not only disposed of 48,000 lb of scrap copper but broke up two ancient steam-driven compressors for scrap iron. Another utility, with an annual contract for scrap removal in effect for many years, has reported a considerable increase in the net junk outflow even while a scavenging program for reconditioning every possible used part by welding or other methods is under way.

Repair schedules call for building up worn stoker crankshafts in an automatic welding lathe and refinishing shafts for ashcars, cranes and pumps. New ends are welded on worn pump sleeves. Plates, welded in and ground smooth,

*For copies of "The Erie Plan" and other information, write WPB, Bureau of Industrial Conservation, Washington, D. C.

Reclaiming usable worn, damaged or obsolete equipment is the first step in any intelligent salvage program, provided the overhauled part can be used immediately. Here metal spray reclaims a heavy shaft by adding only a few pounds of new metal. Coarse threads cut in worn section are knurled to increase mechanical bond, then sprayed to build up thickness. After the shaft is turned to proper diameter and polished, it will go back in service

Photo by Consolidated Edison Co of New York

CAN HELP WIN THIS WAR

Unsuspected or ignored metals and waste lie dormant in power plants, factories and institutions, while steel mills are sending out an SOS for six million tons more scrap than is now in sight. This is your war; you can help War Production Board "Get in the Scrap" in a hurry

Heavy steel scrap—old discarded structural members, pipe, castings or obsolete machinery. An all-out cleanup of every industrial plant will go far toward finding six million tons of extra fodder for ever hungrier steel mills on full rations

give a new lease of life to old pump impellers. Weld metal replaces broken teeth in gears of the coal-handling system. Valve stems are straightened and metal added if necessary by spraying or welding. Even turbine blades are being judiciously silver soldered.

One company repeatedly lists all surplus and inactive items. In addition, a survey uncovered several cranes that can be released for other uses. A quantity of boiler tubing has been sent to outside mills for redrawing into pipe. Reclaimed solder from cable joints is reinvigorated with a small amount of virgin tin. Reinforcing rods tempered produce an excellent tool steel.

Industrials, too, are discovering unsuspected weapon-fodder. A Pennsylvania coal company not only found 290,000 lb of miscellaneous iron and steel, but also raised 57,000 lb of cast-iron wheels, 11,000 lb of brass and bronze, 22,000 lb of copper and 1500 lb of waste paper. A manufacturer of gas appliances cleared out his salvage parts department to the tune of 90 tons of scrap. A company in California liquefied over 800 tons of rails long frozen by a claim suit. An Ohio cement mill ferreted out two carloads of scrap iron and will keep at the collection work until everything not usefully nailed down has been turned over.

The Army is playing its part in relieving shortages by allowing 800 different substitutions in its specifications. Bronze finishes are no longer required for 174 products; brass has been eliminated for 116 other items; zinc has been crossed out of 93 specifications, nickel from 78, copper from 66, bronze from 68 and aluminum from 58.

These examples represent but a few of many actual instances of organized effort. They point the way for thousands of industrial establishments to make a direct contribution to the production of guns, tanks and shells. Boiler rooms, turbine basements and process plants, notorious for accumulation of spare items laid away for "someday" contingencies, now become potential raw material stockpiles.

No part of this salvage program aims at removing useful parts from service or stock where a reasonably immediate need exists or is foreseen. Nor should items that can be returned to market through the manufacturer or distributor, or by direct swap, be degraded to junk. The point is that an all-out cleanup in many instances has disclosed unsuspected quantities of neglected scrap that would otherwise serve no useful part in the war effort or anywhere else.

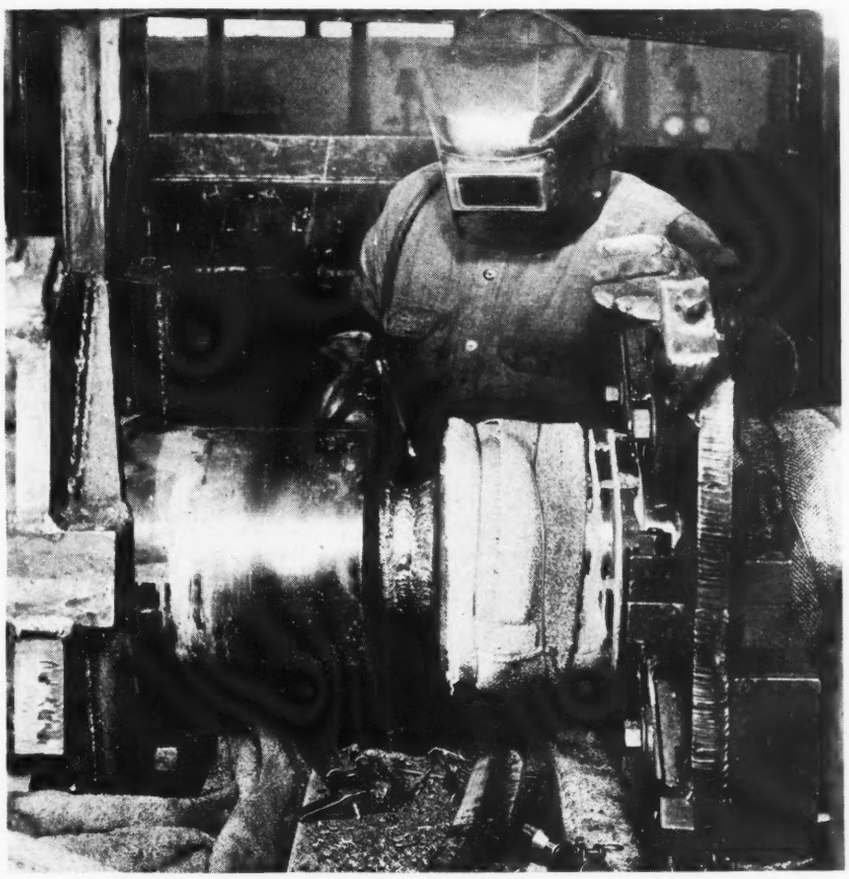
A simple but effective program has been developed by the Industrial Salvage Section of WPB. It works best when stimulated by some energetic individual already part of an industrial organization, not by compulsion. This means that some one man in every power plant and factory has to be sold that the need for scrap is critical, that each plant can make a worthwhile contribution to actual war production, and that he, as an individual, can and should *do something* about it.

The first step is a housecleaning survey of *your* plant, repeating under your breath, "If I were 20 years younger and flying a plane over the Pacific, would I rather have that piece of pipe lying idle in America or its equivalent weight as shells in my ammunition belts?" Or perhaps, "Wouldn't that bronze valve body serve as part of a Liberty ship?"

Once you are in the "all-out" mood, obsolete machinery, spare pipe, unusable stock take on a new value, not in money, but in their worth as direct contribution to war production. The rules of the game are simple. Uncover the scrap, segregate alloys and copper, call in a local waste dealer and your part is done for the initial stage. Follow-up regularly, say once a month, because the scrap shortage is expected to last months or even years.

In normal times iron and steel scrap supplies about one-half the raw material for steel production. Scrap is to steel as

Classifying incoming scrap material speeds the junkman's job. Here heavy pieces go one way and smaller items another. Alloys, copper, and an occasional usable tool or part are rescued. Even small amounts are now precious because the need is critical



Welding plays a big part too. Many pounds of new steel won't have to be diverted from tanks and guns because this operator can weld broken sections of 9-in. pump shaft. Broken ends, cut down to socket and nipple, are built up with several inches of weld metal. *Photo by Consolidated Edison Co of New York*

yeast is to bread. Minimum limits for scrap are estimated at about 25% of steel production. Normal sources cannot supply usual amounts because existing equipment is being nursed along beyond its economic life span.

Copper, even more critical, will be needed to the tune of five million tons between now and the end of 1943. Normal sources will provide only about three million tons of new copper.

Alloying elements present another picture. We are dependent on other countries for 14 important raw materials. We normally use 25% of the world's production of manganese but produce less than 1%. We require over half the total production of nickel, but only a few hundred tons a year have been previously available within our own borders. Other imports include chromium, tungsten, antimony, tin, mica and rubber. Thus any alloy containing one or more of these metals, if it can be segregated at the source where its composition is known, can be returned to mills that turn out similar alloys as scrap of greater strategic value than if returned to common steel.

Enlist in the war on waste, don't throw away anything but dirt, get in the scrap, and do it now. The machinery of collection is already functioning; it waits only for new sources of raw material—just plain junk.

Hot-Solution Method Speeds Transformer Paint Removal

Heavy coats of old paint on tanks and radiators cause dangerously high temperatures in transformer oil and windings. Get rid of the paint by this easy quick method

By ARTHUR P SCHULZE
Oakite Products, Inc

▶ WAR INDUSTRIES working around the clock require every kilowatt-hour that power plants can produce. Because new capacity cannot be created overnight, power engineers must stand alert to utilize every maintenance and operating procedure that will increase dependable output.

Outdoor transformers are usually painted once or twice a year for protection against rust. These coatings, if left on year after year, eventually become thick and act as an effective heat insulator that reduces transformer capacity. Economical and quick paint removal becomes at the same time a necessity and a problem. To do the job by scraping, chipping, chemical paint removers or combinations of these methods is difficult because of the radiator fins or tubes; areas behind tubes and other inaccessible places on a transformer are hard to get at to remove the paint; the cost of doing the work is high; a large amount of labor is required; and the transformer is out of service for some time.

Paint-Removal Equipment

In one central station a commercial self-contained oil-heated paint-removing unit, Fig. 4, was purchased. This is equipped to heat the solution, pump it to the flow-on spray nozzles and reclaim it after it has flowed over the paint. This unit is mounted on skids and can be moved from one place to another as required.

Heating is done with kerosene blast torches which throw flame through steel tubes submerged in the stripping solu-

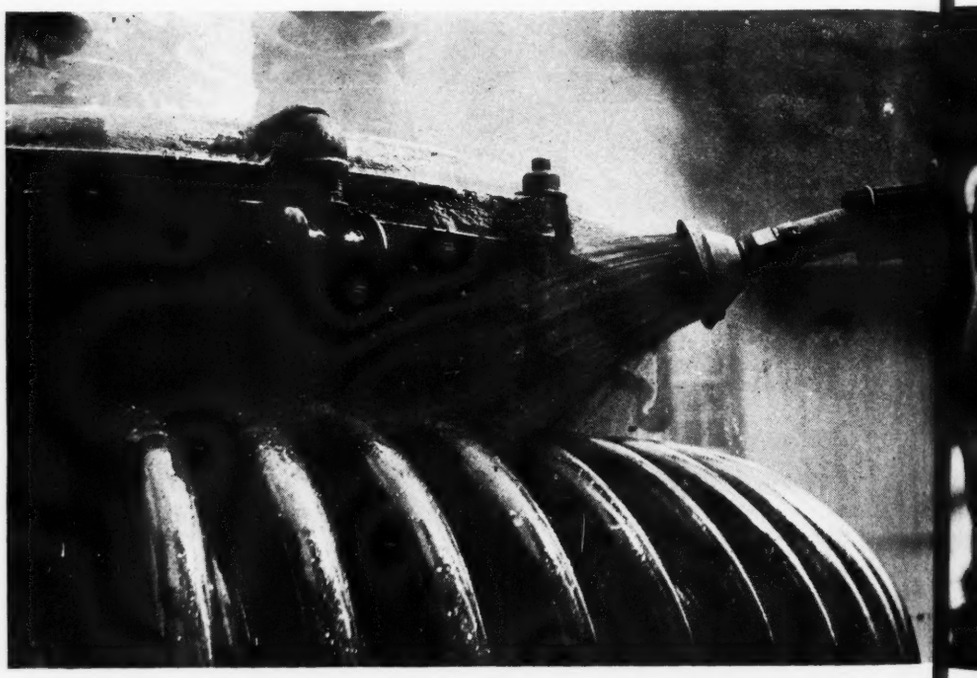


Fig. 1—Hot alkaline paint-stripping solution is pumped to a nozzle at the top of the transformer and is sprayed over a section of the casing and radiators. Fig. 2—Hot solution and paint is recovered in a canvas or metal trough at transformer bottom and pumped back to heating tank

tion, maintaining it at 200 F throughout the operation. If the unit is installed in a permanent location where steam at 50 or 100 psi is available, heating may be by steam coil placed in the solution.

The stripping solution is an alkaline material designed for this work and is effective on a wide variety of paints. Concentration is usually 8 to 12 oz to each gallon of water, depending on conditions. The tank, Fig. 4, holds 90 to 100 gal. Patented procedure for applying solution is known as the *hot flow-on method*.

After being heated to operating temperature, the solution is pumped to the highest level of one section of the transformer to be stripped. From there it flows by gravity through a specially designed shower nozzle over radiator fins and tubes, as in Fig. 1, at a rate of from 4 to 5 gpm. The stripping solution turns the paint to the consistency of soft mud. This is removed by the continual solution flow without brushing or scraping. The procedure is repeated on other transformer sections until all paint is removed from the unit. The solution can be easily directed to reach exposed surfaces hard to reach by other methods. Fig. 3 is a top section of the same 2500-kva transformer, Fig. 1, after the paint has been stripped from it. Immersion of parts in a heated solution is one of the most effective means of paint stripping. The hot flow-on method simulates this for all equipment too large for tank immersion, because it provides for the hot solution to be progressively applied to all exposed areas of surfaces to be treated. It also has the advantage of a constantly flowing solution that helps carry away the dissolved paint.

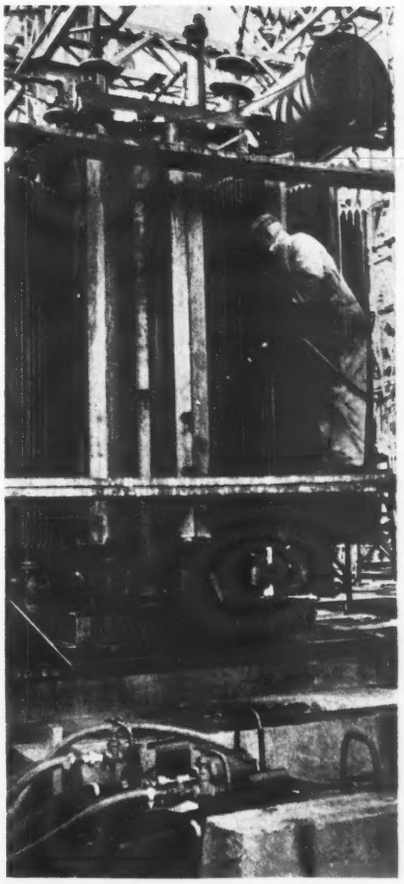


Fig. 5—Stripping paint from a 15,000-kva outdoor high-voltage self-cooled transformer

Several ways of reclaiming the solution may be utilized. Fig. 2 shows one of these methods. Troughs made of cotton duck placed at the bottom of the transformer catch the solution, from where it is pumped back to the stripping-unit heating tank for re-use. In some cases, metal catch pans may be employed.

Removal of three coats of paint, primer, secondary coat and aluminum, from the tank and radiators of a 5000-kva transformer in less than two hours shows the saving in time and money that was and can be made on this work.

Fig. 3—Section of top of 2500-kva transformer, Fig. 1, showing how stripping solution completely removes paint. Fig. 4—Portable units for heating paint-stripping solution with kerosene torch are provided with motor-driven pumps to deliver the hot solution to the spray nozzle above the transformer and to return used solution to the heating tank

How To Calculate Temperature Rise

Energy added to water through the pump shaft is negligible at low pressures but should be taken into account for high-pres-

▶"How do I calculate the temperature rise of water passing through a pump?" is a question frequently raised both by designers and operators of high-pressure steam plants. When water is pumped for a 100-psi steam plant, the energy added to the water by the pump, expressed as Btu, is negligible compared to the heat subsequently added in the boiler. In 2500-psi operation, for example, energy added through the pump shaft at full load raises feedwater temperature some 8 F and increases enthalpy about 15 Btu per lb. Energy added thus amounts to about 1.5% of the total required to convert the water to steam.

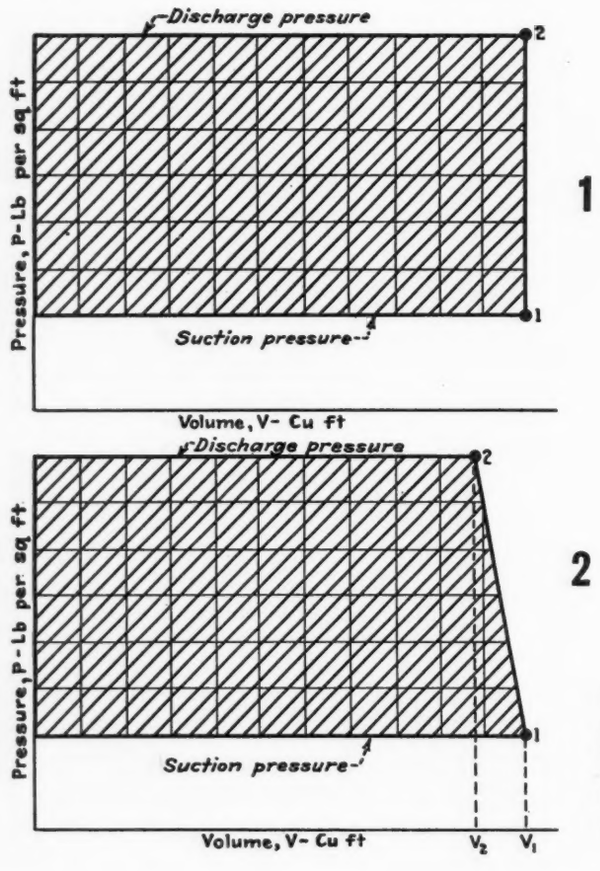
Exact calculation requires closer scrutiny of the actual properties of water than has been customary for lower pressures. Approximate values, however, can be found by a simple method that satisfies most practical needs.

Energy added by pumping to high pressures requires recirculation of feedwater at light loads to prevent overheating pump parts. This is just the opposite of low-pressure centrifugal pumps, which can operate indefinitely at complete shutoff without experiencing overheating troubles.

While several existing references cover the calculation of pump-energy transfer, many engineers still do not understand clearly the theory and method of computation. To visualize the problem best, first consider water as some kind of a perfect fluid, truly non-compressible, handled by a perfect pump with 100% efficiency.

Then the pressure-volume diagram, like the indicator card of a piston pump, will be a rectangle as shown in Fig. 1. All the energy added to the water through the pump shaft is represented by the cross-hatched area on the diagram. For one pound of water, this energy equals the difference between the discharge and suction pressures multiplied by the specific volume. To make the computed value of the work done dimensionally correct, pressures are expressed in lb per sq ft and volume in cu ft.

*Professor of Mechanical Engineering, Columbia University—Consulting Engineer, American Gas & Electric Service Corp



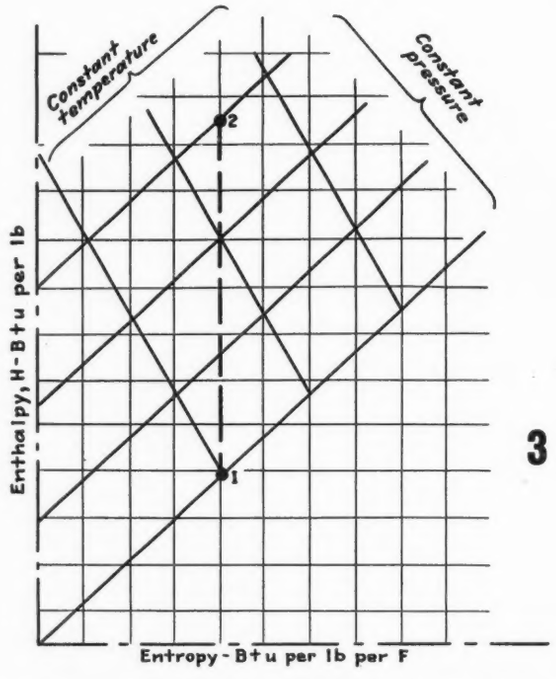


Fig. 1—If water were truly non-compressible, the indicator card of a perfect pump would be rectangular and no temperature rise would take place. Fig. 2—Actual compression, exaggerated here, results in reducing volume and raising temperature. Fig. 3—Section of Mollier chart for water on which temperature rise and increase in enthalpy can be read directly.

in High-Pressure Pumps

sure boiler plants. Professor Theodore Baumeister* gives the exact method and a satisfactory approximation for usual work

In a pump, the work done must appear as a change in enthalpy of the water. If the water is non-compressible, the rectangular card of Fig. 1 applies. The final volume equals initial volume, and the change in enthalpy is calculated as the product of the pressure change and the volume. To express the enthalpy change in Btu per lb, divide by 778.

For the incompressible fluid, there is no change in internal energy and consequently no change in temperature. All the pump energy is transferred to the water as increased pressure. Example 1 shows a numerical computation, assuming a theoretical perfect pump.

If the real properties of water are considered, even in a perfect pump, the results differ from the usual assumption of non-compressibility. The greater the pressure difference, the greater the error. The compression of water, exaggerated in Fig. 2, becomes a curve on the indicator card similar to the compression phase for a gas or vapor.

The work of compression can be computed by thermodynamic methods. For adiabatic (constant entropy) compression, the work between points 1 and 2 equals the change in internal energy of the water. The temperature, even in a perfect pump, rises. For the complete pumping cycle, the enthalpy increase is the sum of the pressure energy and the internal energy added by compression.

Calculations can be made most conveniently by use of a Mollier chart[1] for water, the procedure being identical with a steam-turbine calculation. The process is shown diagrammatically in Fig. 3. The work of the pump cycle of Fig. 2 is the difference between final and initial enthalpies at points 2 and 1 of Fig. 3. For a perfect pump, these lie on a constant-entropy line connecting the suction and discharge pressures. The enthalpies and accompanying temperatures can be read directly from the Mollier chart. See Example II. Raising the pressure of a compressible fluid with a perfect pump raises temperature an appreciable amount.

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[1] *Thermodynamic Properties of Steam, Keenan & Keyes, John Wiley and Sons; Vapor Charts, Ellenwood & Mackey, John Wiley and Sons.*

EXAMPLE I

Non-Compressible Fluid With Perfect Pump

Saturated water at 200 F, considered as a non-compressible fluid, is delivered, by a pump with 100% efficiency, at a discharge pressure of 3000 psi absolute. What is the final enthalpy and temperature?

From the steam tables:

Pressure, $P_1 = 11.5$ psi, abs
Enthalpy, $H_1 = 168$ Btu per lb
Volume, $V_1 = 0.01663$ cu ft per lb

The work done by the pump:

$$W = \frac{(P_2 - P_1) \times 144 \times V_1}{778}$$

$$= \frac{(3000 - 11.5) \times 144 \times 0.01663}{778}$$

$$= 9.2 \text{ Btu per lb}$$

Final enthalpy and temperature:

Enthalpy, $H_2 = 168 + 9.2 = 177.2$ Btu per lb
Temperature, $T_2 = T_1 = 200$ F

EXAMPLE II

Raising Compressible Fluid With Perfect Pump

Saturated water at 200 F is delivered, by a pump with 100% efficiency, at a discharge pressure of 3000 psi absolute. Taking into account the compressibility of water, what is the final enthalpy and temperature?

From the steam tables:

Pressure, $P_1 = 11.5$ psi, abs
Enthalpy, $H_1 = 168$ Btu per lb
Volume, $V_1 = 0.01663$ cu ft per lb

From the Mollier chart for water (Keenan & Keyes, Fig, 3, page 75, or Ellenwood & Mackey, plate 8, page 24):

Final enthalpy, $H_2 = 177.2$ Btu per lb
Final temperature = 202.5 F
Temperature rise $= T_2 - T_1 = 202.5 - 200 = 2.5$ F
Work done $= H_2 - H_1 = 177.2 - 168 = 9.2$ Btu per lb

EXAMPLE III

Raising Compressible Fluid With Real Pump

Saturated water at 200 F is delivered, by a pump with 60% efficiency, at a discharge pressure of 3000 psi absolute. Water handled is 300,000 lb per hr and the pump requires 1807 shaft hp. What is final enthalpy and temperature?

From the horsepower and flow rate, the actual increase in enthalpy is:

$$H_2 - H_1 = \frac{\text{shaft horsepower} \times 2545}{\text{flow, lb per hr}}$$

$$= \frac{1807 \times 2545}{300{,}000}$$

$$= 15.3 \text{ Btu per lb}$$

An alternate method, using the enthalpy increase from Examples I and II, 9.2 Btu per lb, is:

$$H_2 - H_1 = \frac{9.2}{0.6} = 15.3 \text{ Btu per lb}$$

The final actual enthalpy leaving the pump is then:

$H_2 = 168 + 15.3 = 183.3$ Btu per lb

From the Mollier chart, for 183.3 enthalpy and 3000 psi, the actual water temperature is read as 208 F.

EXAMPLE IV

Approximation by Non-Compressible Fluid With Real Pump

For the same initial conditions as Example III, but assuming the water is non-compressible and all pump losses (inefficiency only) are considered as raising the temperature, what is the final temperature?

Temperature rise

$$= \frac{\text{horsepower losses} \times 2545}{300{,}000}$$

$$= \frac{\text{shaft hp} \times (1 - \text{eff}) \times 2545}{300{,}000}$$

$$= \frac{1807 \times (1 - 0.6) \times 2545}{300{,}000}$$

$$= 6.1 \text{ F}$$

Final temperature $= 200 + 6.1 = 206.1$ F.

In practical application of these principles to real pumps of less than 100% efficiency, within reasonable limits of error, it is customary to assume that all the pump losses appear as increased enthalpy of the water. Of course, some of the bearing and gland losses, as well as heat radiation, actually leave the cycle, but they are usually small and are difficult to segregate from the larger heat quantities involved in disk and fluid friction, impact and eddying.

Hence if the total shaft horsepower of pump input is known, converted into Btu (2545 Btu per hphr), and considered spread through the weight of water flowing, the total increase in enthalpy can be calculated directly. See Example III. Then the final temperature can be read from the Mollier chart for the stated enthalpy and pressure.

A simple and practical approximation to this calculation, preferred by many engineers as sufficiently accurate for usual heat-balance work, treats the water as non-compressible and assumes that the pump inefficiency all goes toward raising the temperature. For the 60% efficient pump of Example III and the other corresponding data, Example IV shows a temperature rise some 2 F less than Example III.

The method of Example III is sound fundamental procedure using the real properties of water and should be understood by all who are required to make such computations. The approximation of Example IV, however, is extremely simple, and errs on the side of lower final temperature which can be construed as making allowance for radiation and bearing losses that do not actually become transferred to the water. Furthermore, at light loads on the pump, the pump inefficiency is of greater significance than the compressibility effect in increasing the water temperature because of the smaller quantity of water flowing. Thus, once the principles are well understood, the approximate simplified calculation can be used with safety for all practical heat-balance computations.

✦ ✦ ✦

Iron Horse Speeds Marine Turbines

Production of marine turbines and gears started in the new Westinghouse merchant marine works before the regular steam heating system could be installed so temporary tracks were laid to a point near the unfinished end of the plant and a retired railroad locomotive rented for the remainder of winter. Plant has been operating on a three-shift basis since mid-February.

A regular operating crew of engineer and fireman keeps the old locomotive running 24 hours a day. Note 60-ft guyed steel stack that provides natural draft and carries smoke above building. Soon the engine can be backed away to make room for plant addition.

Proper Handling and Storing Keeps Good Lubricants Good

Oil is ammunition—use it wisely. Here is a blueprint for design of storage spaces, containers and dispensing devices and for keeping them and the lubricants free from contamination

By JAMES I CLOWER
Associate Professor of Machine Design
Virginia Polytechnic Institute

► REGARDLESS OF HOW PRECISELY a machine has been designed and built, it cannot produce at maximum capacity unless it is properly lubricated at all times. New refining processes produce lubricants that are better than ever; greater care insures that containers are thoroughly clean before filling; and refiners make every effort to supply clean products suitable for the consumer's purpose. Here the refiner's responsibility ends and the user's responsibility begins.

Oil and grease drums must not be set in the most convenient dark corner with lids off and bungs out. Dispensing equipment must be cleaned periodically. If a lubricant is permitted to become contaminated and dirty and then is used, excessive wear, loss of power, and reduced production result.

Proper storing and handling of lubricants generally involves a consideration of (1) construction, size, and location of storing facilities, (2) storage tanks and accessories, (3) handling equipment, (4) measuring devices, (5) methods and manner of distribution to various departments, (6) lubricants used, (7) extent to which records are kept.

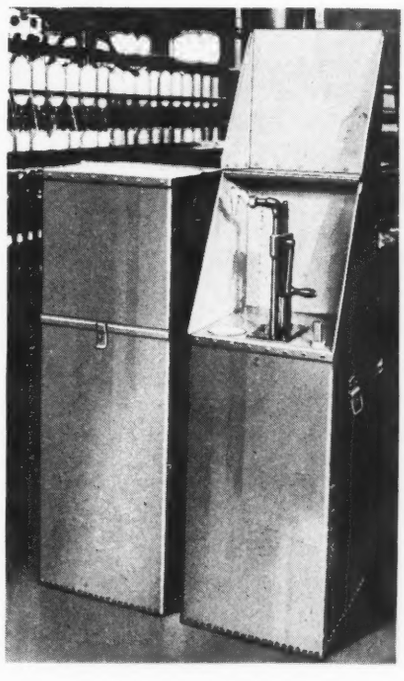
Fireproof Oil Room

The need for a fireproof oil room or house cannot be overemphasized, Figs. 2, 3. Provide floors with adequate drains so that they can be cleaned easily.

To eliminate hoisting, which is slow and expensive, arrange for one-level handling, if possible. Hoisting sometimes results in rough handling which may lead to contamination of the lubricant through sprung seams and broken seals. If possible, place the unloading platform on a level with the floor of cars, docks, or trucks, to permit drums to be rolled, trundled on hand trucks, or handled by portable conveyors directly to the filling hatches, if basement tanks are used.

In deciding whether to provide an oil-house or a special room for storage keep in mind that in many cases considerable savings can be realized by purchasing lubricants in large quantities, such as tank-car lots. Plants near oil-supply depots generally need not provide as much storage as those farther away. Many small plants thus favorably located find it satisfactory to set apart a portion of the engine room or general storehouse for lubricants, which are kept in shipping drums and packages or small tanks with pumps, Fig. 1.

Fig. 1—Cabinet tanks with hinged covers and measuring pumps located at convenient points throughout the plant for storing and dispensing oil



Arrange for both storing and dispensing oil. Tank capacity depends on lubricants used (greases, lubricating oils, core oils, cutting oils, etc), daily consumption, space available, availability of steam for heating tank-car shipments, and the relative location of the storage house with respect to the rest of the plant.

To avoid long unloading lines, place tank-car storage as close to the unloading point as is practical and as close as possible to the center of distribution. If both conditions cannot be met, a compromise should favor quick and inexpensive distribution of the oil through the plant.

Pumping oil is undesirable, consequently place storage tanks so that oil will flow by gravity from cars to tanks or to portable dispensing equipment.

Heating of Oil

Because all lubricants become viscous at low temperatures provide steam or hot-water coils for heating. Hot-water coils generally give better temperature control than steam coils. These coils may be either immersed or placed outside the tank, preferably underneath. Generally lubricants should not be heated above 100 F, sufficient for rapid flow. Most lubricants undergo harmful changes if heated above this temperature for any length of time. Do not expose lubricants in storage to extreme temperatures. Steam-cylinder oils are likely to separate if kept at too low temperature and fluid greases tend to separate if exposed to high temperature. Keep drums and

Fig. 2—Corner of properly designed and maintained oil storage room where suitable tanks with pumps are provided for storing and dispensing the oil and convenient means are made available for handling drums and other oil-receiving containers

other packages indoors to avoid wide temperature variations and to prevent brand names becoming obliterated by the weather.

All lubricants are combustible, therefore keep oil-soaked rags, waste, and other material in approved containers. Place approved fire extinguishers at convenient points.

Use sheet iron or steel storage tanks. Do not use galvanized iron because the zinc is likely to react with oils, especially if they are compounded. The type, number and size of tanks required depends on the volume and nature of lubricants to be stored. It is good practice to put bulk storage tanks in a basement with the main floor used for receiving, delivering, and storing. The main floor is thus kept free for delivery pumps, accessories and office space, as in Fig. 3.

Cleaning Tanks

Breather vents should be supplied on all tanks. Moisture and dirt accumulate in tanks and for easy cleaning they should have a conical or sloping bottom, Fig. 5, or be set at an angle, with drain plugs at the lowest level. Fit the end of oil-removal pipes with a foot valve several inches above the tank bottom, so that it will tap clean oil. Clean underground tanks with a suction pump not less than twice a year. Thoroughly clean large tanks equipped with manhole openings. Tie rope under the armpits of the man who enters the tank, and station two men at the manhole to lift him out if he is overcome by fumes. Provide the man in the tank with a gas mask. The watchers should communicate with him at frequent intervals, and he should come out for air every 15 min. Clean small tanks regularly with kerosene, removing it thoroughly before refilling the tank. Do not use gasoline because of the fire hazard.

Oil-Measuring Pumps

Wherever practicable use sealed measuring pumps for pumping oils out of tanks. Pumps for this purpose are available with built-in indicating meters. A metering device is always advisable so that accurate consumption records can be kept. Measuring pumps save time and labor, enable orders to be promptly filled, and keep the oils clean, at least until they are pumped to the distributing containers.

Provide portable elevators or chain hoists to lift drums and other heavy containers while emptying them into storage tanks. Install a track along the top of all tanks, at sufficient height above them to bring the bungs directly over the filling hatches.

If compressed air is used to transfer oil from dums to storage tanks, make sure it is dry and provide relief valves to prevent excess pressure which might spring the seams of the drum, or cause a serious accident.

Lubricants may be distributed in a number of ways, depending on the lubricant, quantity used, distance from storage to points of use, availability of storage space, applications methods and other factors.

If large quantities are used and if the machines are closely grouped, it may be best to provide pipelines from storage to the machines. If the machines are scattered or if the distance is too great for piping, a portable tank, Fig. 6, may be better.

In large plants where individual operators are responsible for the lubrication of their machines, it is usually best to have several conveniently located stations where lubricants can be obtained. If several lubricants are required, it is generally advantageous to have storage rooms with an attendant. Usually, the amount of lubricants handled in such a station does not warrant a full-time attendant, but it is generally possible to arrange a schedule whereby the attendant can look after several such stations.

Individual Containers

Where the quantity of lubricant handled is small, individual containers, such as in Fig. 1, may be located at convenient points throughout the plant. If the cabinet tank is not warranted, shipping drums may be set on suitable supports, Fig. 4, with faucets and drip pans, or set on end on the floor and equipped with pumps.

Where an oiler takes care of all lubrication, a truck equipped with tanks, racks for bottle oilers and grease guns, containers for waste and rags, drawers for oil and grease cups, grease-gun fittings, and hand tools for making minor repairs are suitable, Fig. 7.

In general, greases are less stable than oils and require more careful handling. They are generally used in smaller quantities than oils, and it is a frequent practice to provide the operator with a small can which he keeps near the machine. It is usual to find the cover off or missing, and the grease exposed to dirt, dust, and frequently

water. If it is necessary to dispense grease in this manner, the container should have a tight cover and the operator should keep it on at all times.

Greatest economy and efficiency in storage and handling and use of lubricants can be effected by having a competent man in charge. Many large plants have found it profitable to employ an engineer who has direct charge of all lubricating matters. In order to have definite information on lubrication costs, accurate records of all purchases and consumption must be kept.

It is of little use to buy high-grade lubricants unless they are kept clean. The poorest grades kept clean and properly applied to the bearing are better than the best when allowed to become contaminated with elements that attack the bearings. Lowest cost lubrication is obtained with high-grade products properly protected against contamination and correctly applied to the bearings.

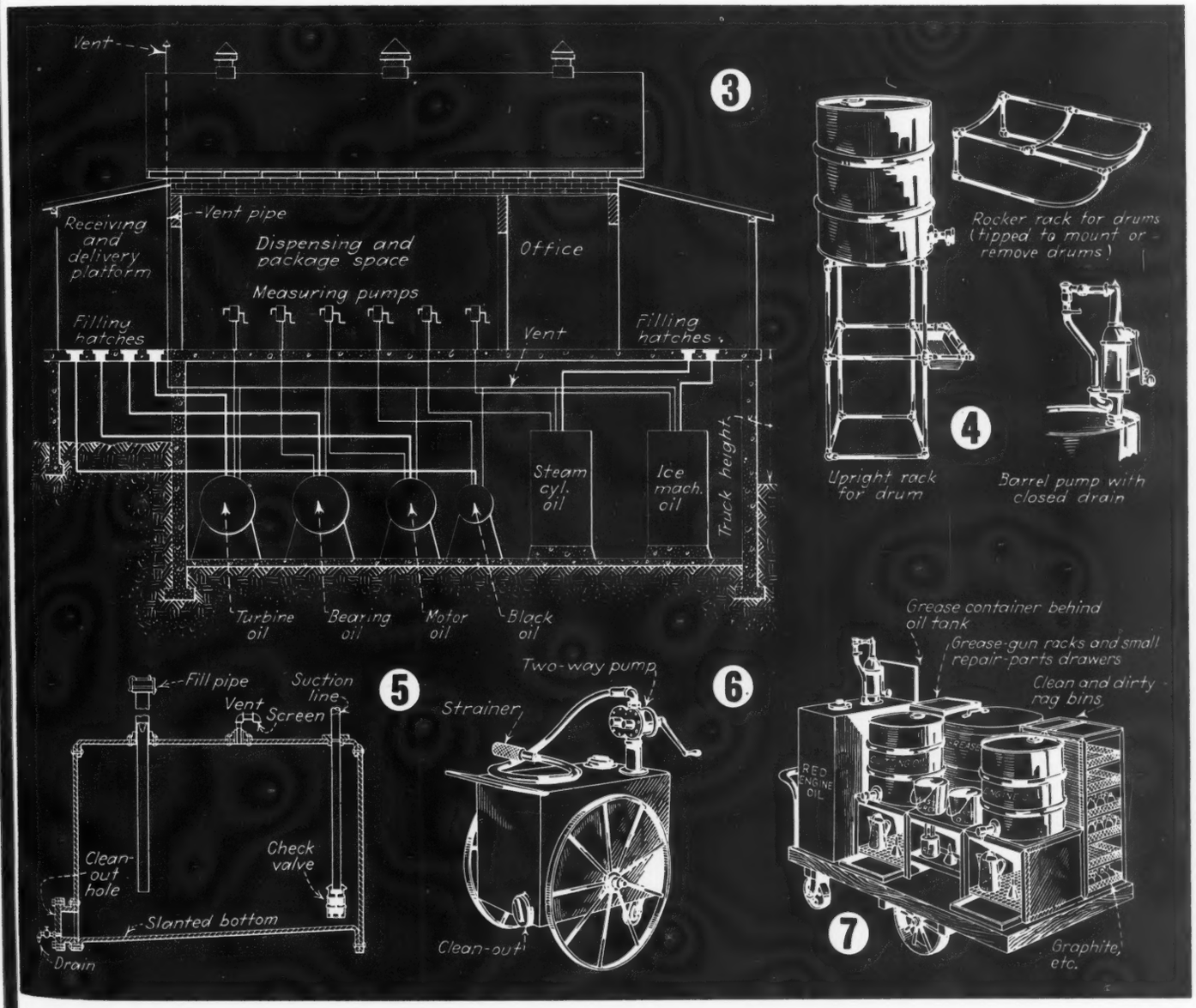
Regardless of how efficiently and economically lubricants are selected and used, if they are improperly stored and handled, all potential benefits are likely to be lost. Cleanliness is the most important factor; such accessories as funnels, measuring cans, grease guns, and oil cans should be kept clean.

Many plants would find it profitable to investigate their whole lubrication program. Surprisingly large savings can often be realized by standardization of both lubricants and accessories.

Frequently, worth-while savings can be obtained by using proper oil-reclaiming equipment. Nearly all oils can be reclaimed, usually to advantage. A reduction in lubrication costs and maintenance expense can often be effected by appliances that economize on consumption, and through the substitution of standard lubricants for high-priced specialties, which are not always necessary.

Among the potential benefits that may be expected from the establishment of a well-planned and organized lubrication program are reductions in machine shutdowns, maintenance costs, spoilage, labor costs, power consumption, and direct lubrication expense—all of prime importance at this time.

Fig. 3—Central oil-storage house showing arrangement of tanks, pumps, filling hatches and other equipment. Fig. 4—In small plants where cabinet tanks are not warranted shipping drums with faucets may be set on suitable supports with drip pans, or drums may be set on end on the floor and equipped with pumps. Fig. 5—Moisture and dirt accumulate in storage tanks and for easy cleaning they should have a conical or sloping bottom or be set at an angle with the drain plug at the lowest level. Fig. 6—Portable oil-dispensing tank with hand-operated rotary pump used to pump oil into or out of the tank. Fig. 7—Portable oil-and-grease dispensing truck for distributing oil from central storehouse to various plant departments



Ingenuity Puts Crawford Clothes Plant On the Line in Four Months

Adapting original layout and equipment selection to meet the priority and delivery situation speeds construction of unique three-pressure-level steam plant with diesels for heat balance

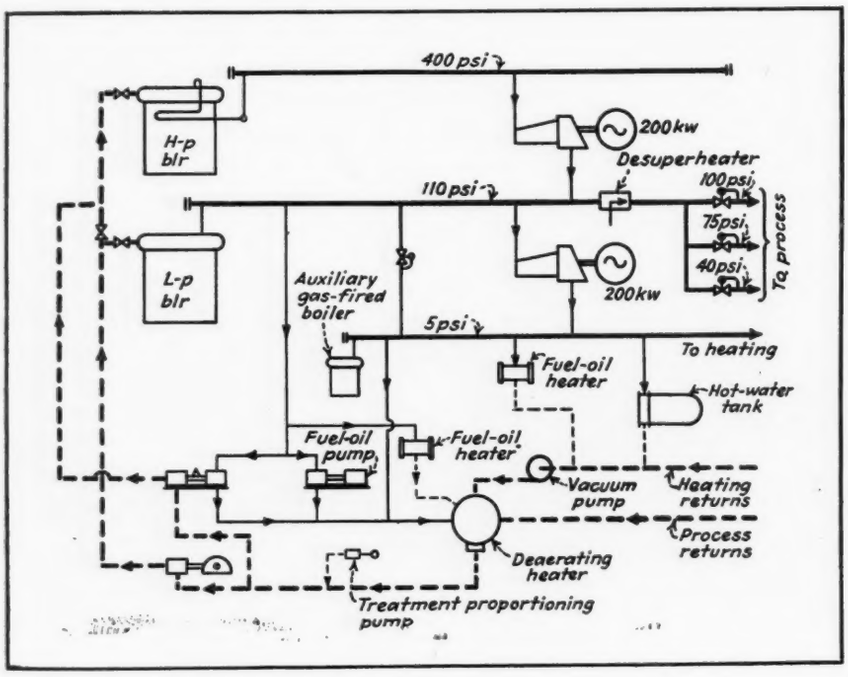


Fig. 1—As finally designed, plant has one high- and one low-pressure boiler

▶ A THREE-PRESSURE LEVEL 400-kw steam plant with 150 kw of diesels for summer heat balance and peak loads serves the new Crawford Clothes factory in Long Island City, N. Y. Because plans for the entire plant were begun in September, 1940, with operation scheduled for January, 1941, it was necessary to adapt the original layout and select equipment to meet the priority and delivery situation that developed during this period. This was successfully accomplished and the factory began manufacturing in February, 1941, only four months after plans were first commissioned.

Designed to supply a 350–450-kw power load and furnish 7000 lb per hr of 110-psi steam for pressing and sponging, and 0–10,000 lb per hr of 5-psi steam for building heating, the original plans called for two 400-psi boilers, each capable of handling the entire steam load. All high-pressure steam was to go to a 200-kw turbine exhausting at 110 psi to process and to another 200-kw turbine discharging to the heating system in winter.

Boiler pressure was selected to give economical heat balance without excessive equipment and piping cost, and without need for equipment not readily available. Choice of two turbine-generator sets rather than a single-extraction backpressure unit gave lower first cost and increased reliability and flexibility.

It soon became apparent that the 400-psi boilers could not be delivered on the short schedule required and it was decided to substitute a low-pressure boiler, on which delivery could be obtained, for one of the high-pressure units. With this boiler supplying the low-pressure turbine and with the diesels in operation, the plant could carry the load until the high-pressure boiler was installed. Accordingly, a 160-lb. unit was ordered and auxiliaries were designed to operate at low pressure, saving high-pressure piping.

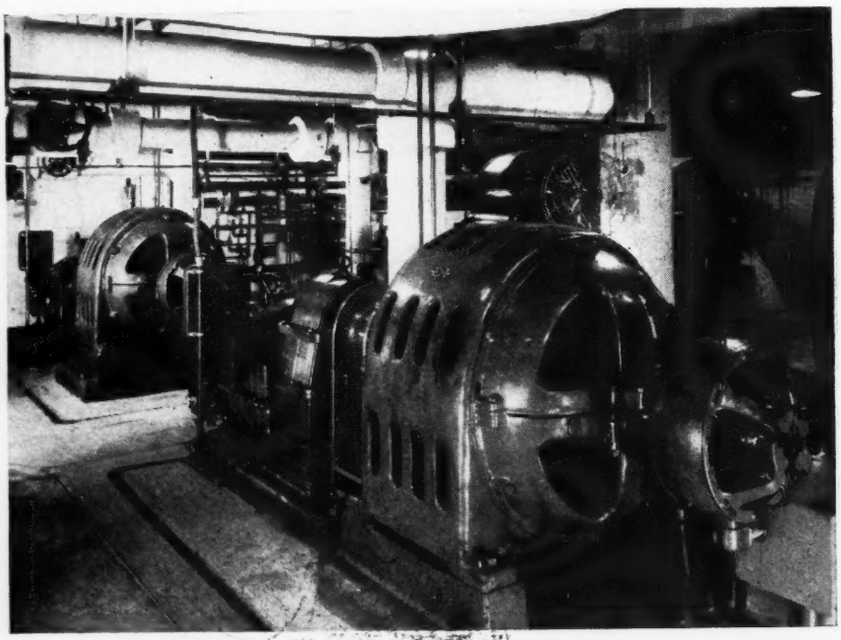


Fig. 3—High-pressure turbine, left, discharges at 110-psi to low-pressure unit at right

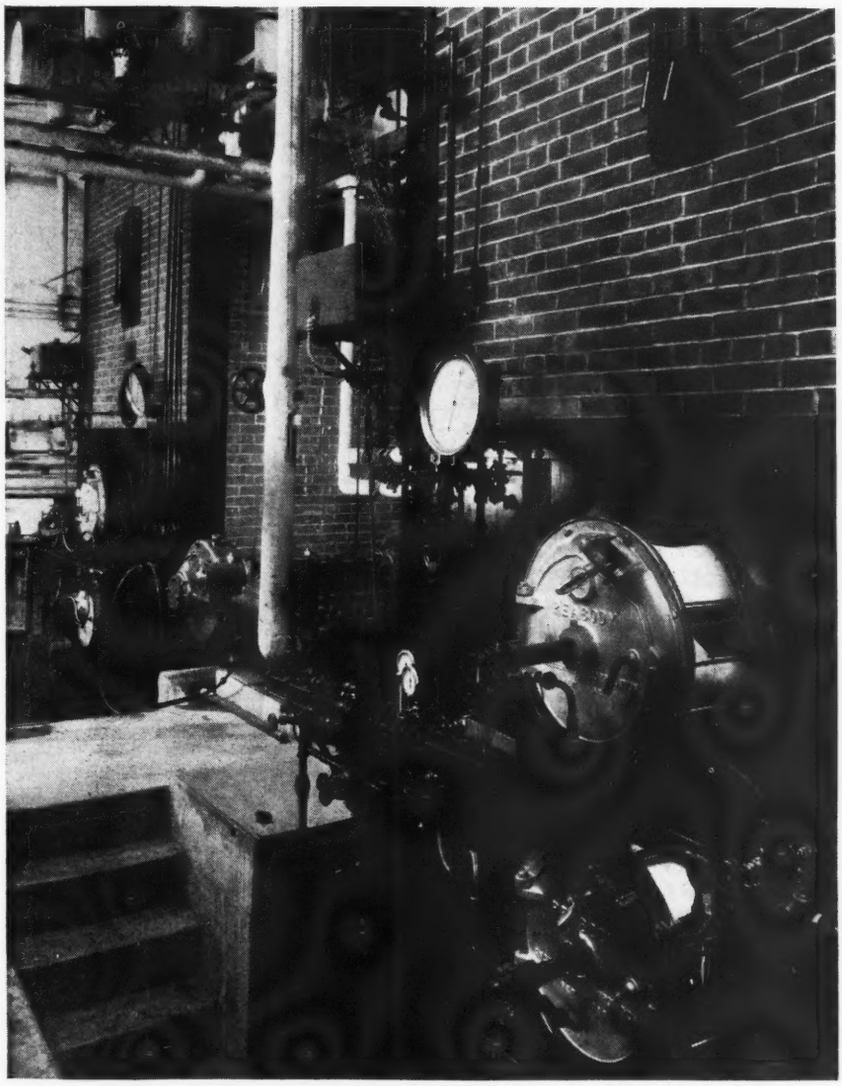


Fig. 2—Two natural-draft oil burners fire each boiler; an evasé stack provides induced draft, eliminating hard-to-maintain steel stack

The flow diagram, Fig. 1, shows the present plant with one high- and one low-pressure boiler. Running both boilers at once is not planned but the piping layout permits such operation if necessary. In this case, the motor-driven piston pump supplies the low-pressure boiler and the duplex the high-pressure. Each turbine is equipped with a speed-responsive governor and a backpressure regulating valve. There is no bypass around the high-pressure turbine; a reducing valve between 110- and 5-psi headers bypasses the low-pressure unit.

As normally operated, the high-pressure boiler supplies steam to the top turbine according to the demands of the 110-psi process load and the low-pressure turbine. The high-pressure unit thus normally operates under backpressure control. The l-p unit operates under speed control when steam demand exceeds electrical load, with the excess requirements of the 5-psi system made up through the reducing valve. When electrical demand exceeds steam demand, the low-pressure turbine operates on backpressure control and the diesels balance the power requirements and regulate frequency.

In summer, the high-pressure turbine operates to supply the process load and the diesels handle the remaining electrical load. If demand exceeds the output of this combination, the low-pressure turbine goes into operation, exhausting to atmosphere. There is no mechanical tie between the steam and diesel plants.

If the high-pressure turbine goes out of service, the high-pressure boiler can be shut down and the low-pressure boiler used. If desired, the 400-psi boiler can be operated at 110 psi; insertion of a removable spool piece ties the 400- and 110-psi systems together so the h-p boiler can feed the l-p turbine.

Process Steam

The 110-psi header supplies, through reducing valves, 100-psi steam for sponging and 75- and 40-psi steam for pressing. The 5-psi header feeds the vacuum-heating system and the hot-water heater. Returns from process and heating go to a deaerating heater where feed temperature is raised to 220 F by exhaust steam from auxiliaries and by 5-psi steam from the header, if needed. Depending on heat-balance, either motor-driven or duplex pump is operated.

Building-layout problems required separation of boiler and engine rooms. These are about 50 ft apart, connected by a tunnel carrying steam and water piping and electric conduit. Two nat-

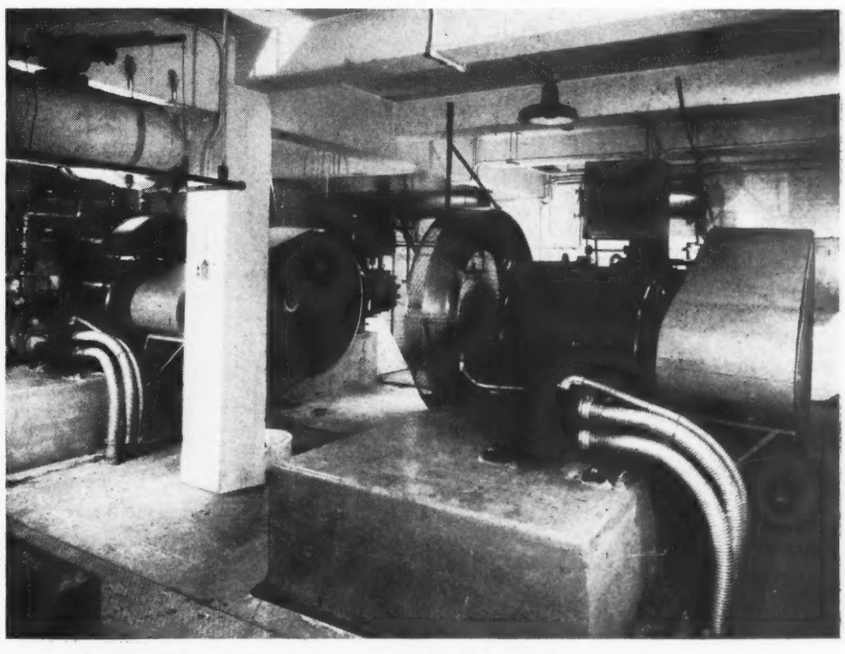


Fig. 4—Horizontal diesels are V-belted to 1200-rpm 75-kw generators

ural-draft oil burners fire the low-head Stirling high-pressure boiler which is designed for 450-psi working pressure and is equipped with a superheater to deliver 700-F steam. It proved most economical to restrict the main steam line to the engine room to 3 in. dia, taking a maximum pressure drop of 35 psi. Loops take care of expansion on high-pressure steam lines which have welded and Van Stone joints; low-pressure lines are fitted with expansion joints.

Low-Pressure Boiler

The low-pressure boiler (160-psi working pressure) is also equipped with two natural-draft burners. Gas ignition torches are used on both boilers. To avoid need for a tall steel stack, which would have disfigured the building and have been hard to maintain, an evasé stack was installed.

Fuel-oil tanks for both boilers and diesel engines are located under the street just outside the plant. Three heaters, two operating on 110-psi steam and one on 5-psi steam, bring oil to required burner temperature. A small automatic gas-fired boiler stands by to provide 5-psi steam for starting up cold boilers. Both high- and low-pressure boilers are equipped with automatic combustion control.

The high-pressure turbine drives a 208-volt 2-phase 60-cycle 4-wire 0.8-pf 200-kw generator through an integral 4500–1200-rpm reduction gear. At the exhaust pressure of 110 psi, steam temperature runs about 550-600 F; a steam-atomizing desuperheater installed in the 110-psi header controls steam temperature going to process. The low-pressure turbine drives an identical generator.

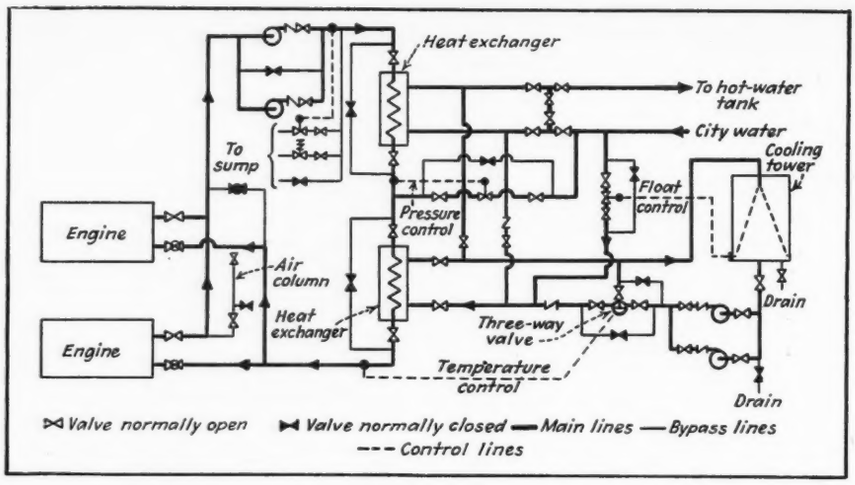


Fig. 5—Diesel cooling circuit provides for jacket heat recovery

The engine room houses, in addition to the turbine-generators, two horizontal 2-cyl 2-stroke-cycle 257-rpm diesels V-belted to 1200-rpm 75-kw generators with direct-connected exciters. Units of this type were selected for low first cost and quick delivery. A motor-driven fuel pump, with a hand pump for emergencies, transfers oil from the 5000-gal underground tank to the 52-gal day tanks. Flow to each engine is filtered and metered.

Fig. 5 shows how the diesel jacket-water circuit is arranged for heat recovery. The engine-jacket circuit, which is closed, contains two 80-gpm pumps and two heat exchangers, with necessary bypasses and cross-connections. As required by demand for hot water, city water enters the heat exchangers, absorbs jacket heat and passes out to the hot-water tank shown in Fig. 1. Makeup for the cooling tower is float controlled. The diagram shows the necessary valves and pressure and temperature controls. The second heat exchanger is tied into a circuit leading to a cooling tower located on the engine-room roof. Total cooling requirements of the engines are divided between the heat exchangers according to hot-water demand.

Principal Power Equipment

Crawford Clothes Co, Long Island City, N. Y.

Steam-Generating Equipment:

High-pressure boiler, low-head, Stirling	Babcock & Wilcox Co
Low-pressure boiler, low-head, 3-drum	Titusville Iron Works Co
Oil burners, 2 per blr, natural-draft	Peabody Engineering Co
Automatic combustion control	Brooke Engineering Co
Soot blowers, h-p boiler	Diamond Power Specialty Corp
Soot blowers, 1-p boiler	Bayer Co
Steam-flow air-flow meters	Bailey Meter Co
Feedwater regulator, h-p boiler	Bailey Meter Co
Feedwater regulator, 1-p boiler	Stets Co
Non-return valves	McAlear Mfg Co
Safety valves	Manning, Maxwell & Moore
Blowdown valves	Yarnall-Waring Co, Everlasting Valve Co
Fuel-oil heaters, 3	Davis Engineering Corp
Auxiliary gas-fired boiler	Mears-Kane-Ofeldt, Inc
Fuel-oil pump, duplex	Dean Brothers Co
Evase stack	Prat-Daniel Corp

Turbine-Generating Equipment:

Turbines, one 400-110-psi, one 110-5-psi	Murray Iron Works Co
Generators, 2, 200-kw, 3-ph, 60-cycle, 208-v	Electric Machinery Mfg Co
Regulating valves, backpressure	Davis Regulator Co
Backpressure relief valves	Crosby Steam Gage & Valve Co
Desuperheater, steam atomizing	Republic Flow Meters Co
Desuperheater control	Foxboro Co
Desuperheater-control air compressor	Worthington Pump & Mach Co

Condensate and Feedwater System:

Deaerating heater	Worthington Pump and Mach Co
Vacuum pump, heating system	Nash Engineering Co
Treatment proportioning pump	Proportioneers, Inc
Oil separator, pump exhaust line	Kieley & Mueller Inc
Feedpumps, 1 motor-driven, 1 duplex	Worthington Pump & Mach Co
Pump pressure governors	Fisher Governor Co

Diesel-Plant Equipment:

Engines, 2, horizontal, 2-cyl, 2-cycle	Joseph Reid Gas Engine Co
Generators, 2, 75-kw, 3-ph, 60-cycle, 208-v	Star Electric Motor Co
V-belt drives	Worthington Pump & Mach Co
Intake air filters	Coppus Engineering Co
Governors, isochronous	Woodward Governor Co
Heat exchangers	Davis Engineering Co
Pumps, jacket and raw-water	Worthington Pump & Mach Co
Cooling tower	Binks Mfg Co
Temperature-regulating valves	Powers Regulator Co
Pressure-regulating valves	Fulton Sylphon Co
Fuel-transfer pump, motor-driven	Ketcham Pump Co
Fuel-oil meters	Buffalo Meter Co
Fuel-oil-tank-level gage	Pneumercator Co
Starting-air compressors	Worthington Pump & Mach Co
Flexible metallic hose	United Metal Hose Co
Silencers	Maxim Silencer Co
Filters, oil	Wm W Nugent & Co

Miscellaneous Equipment:

Gate and globe valves	Jenkins Bros, Fairbanks Co, Reading, Pratt & Cady, Kennedy Valve Mfg Co, Edward Valve & Mfg Co
Relief valves	Manning, Maxwell & Moore
Reducing valves	Kieley & Mueller Inc, Leslie Co, McAlear Mfg Co, Mueller Steam Specialties Co
Flowmeters	Republic Flow Meters Co
Water meters	Worthington Pump & Mach Co, Buffalo Meter Co
Steam traps	K-Master, Sarco Co, V D Anderson Co
Switchboard	Cole Electric Co
Voltage regulators, instruments	Westinghouse Elec & Mfg Co
Foundation isolation, engines and turbines	Korfund Co
Alarm systems, engines and turbines	Minneapolis Honeywell Reg Co

Fit the Reducer to the Drive for Trouble-Free Low-Cost Service

Operation under varying loads subjects speed reducers and gear motors to abnormal tooth stresses and fatigue. W F Plume, Philadelphia Gear Works, shows how to select units for occasional, intermittent, normal or continuous service

▶ A GEAR USED TO CONNECT a motor or other power unit to its load is in a "between the devil and deep-blue-sea" position. Being a positive drive it is subjected to all the bad effects of both the power unit and load. It is therefore imperative that these conditions be taken into account when selecting gear drives for varying loads.

Motor output is usually limited by winding temperature, which must not go high enough to injure the insulation. Conversely, safe gear output depends largely on mechanical rather than thermal effects. Where there is a thermal limit in gear operation because of lubricating-oil temperature this can be taken care of by circulation or suitable coolers.

Fluctuating Loads

A motor driving a fluctuating load may be heavily overloaded at times, but as long as the safe insulation-temperature limits or the maximum torque are not exceeded no harm is done. Loading a gear beyond its normal rating produces abnormal stresses in its teeth and causes them to wear excessively. When gear teeth are subjected to overstressing by shock loads for long periods they may break.

Shock Loads

Shock loads may be transmitted to gears from power units such as internal-combustion engines or from loads such as punch presses, ore and stone crushers. For these and other reasons, characteristics of the power unit and the drive must be taken into account when selecting gears, as well as the horsepower to be transmitted and the hours per day of operation. These requirements for gear selection are no different than for any other mechanical power-transmission equipment if long life and satisfactory operation is to be expected.

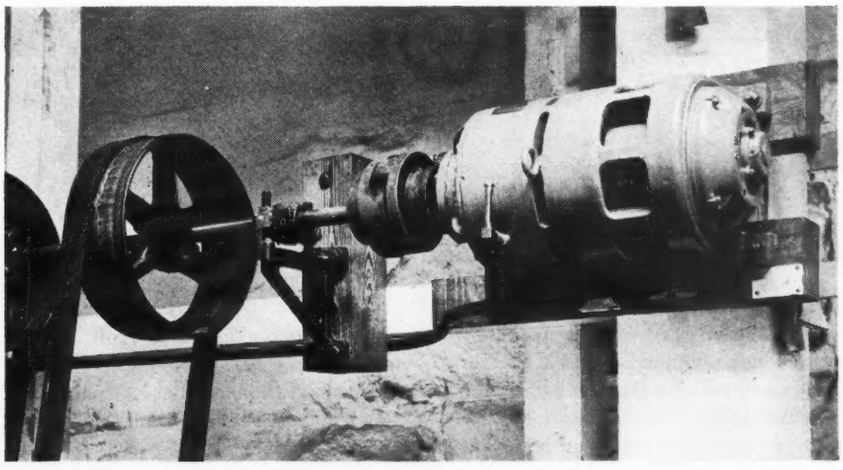
For spur, helical and herringbone gears the different load and power unit requirements are taken care of by service factors established by the American Gear Manufacturers Association and given in the data sheet on page 118. These are for electric motors, multi- and single-cylinder internal-combustion engines. Operation classed as *occasional* assumes 0.5 hr per day; *intermittent*, 3 hr per day; *normal*, 8 to 10 hr per day; and *continuous*, 24 hr per day.

The table also divides the loads into *uniform*, *moderate-shock* and *heavy-shock*. The table therefore covers 36 combinations of drive, hours of operation and load characteristics.

For example, if an agitator is driven by an electric motor and operates only occasionally, averaging 0.5 hr. per day, the service factor is only 0.5, but for normal 8-to 10-hr-per-day operation the service factor is 1.0. This means that the gear for occasional service needs to have only one-half the normal capacity of one that operates 8 to 10 hr per day. If the agitator is driven by a single-cylinder internal-combustion engine the service factor is 1.0 for occasional and 1.5 for normal operation.

Load Classification

Now for the service factors to take care of different loads. An agitator is classed as *uniform* load and when driven by a motor 8 to 10 hr per day has a service factor of 1.0. A reciprocating compressor with three or more cylinders is designated as *moderate-shock* load



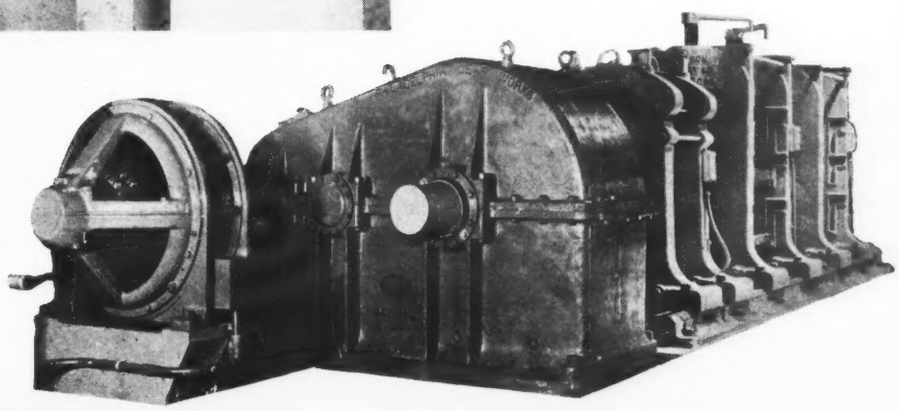


Fig. 1—Compound-planetary gearmotor, wall-mounted to take a minimum of space, coupled to a line shaft. Fig. 2—Double-reduction herringbone-gear speed reducer with a ratio of 40:1 connects 150-hp wound-rotor motor to metal-rolling mill

and is given a service factor of 1.25 for 8- to 10-hr operation when motor-driven. A reciprocating compressor with one or two cylinders is listed as *heavy-shock* load and given a service factor of 1.75 for 8- to 10-hr operation. If this compressor is driven by single-cylinder gas engine the service factor is 2.25 for 8- to 10-hr operation.

Fig. 3—Vertical 5-hp, 1750-to-30-rpm gearmotor direct mounted to drive an agitator

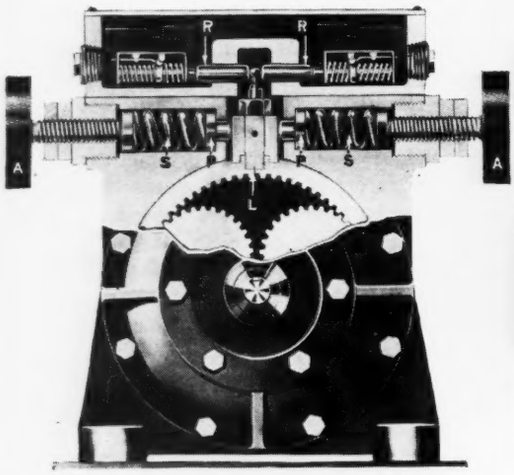


Fig. 4—Cross-section through planetorque gear speed reducer that trips motor switch in case of heavy overload, protecting the motor and gears

As an example, assume that a heavy-duty belt conveyor, the head shaft of which operates at 100 rpm, is to be driven by a 25-hp 1750-rpm squirrel-cage motor through a gear reducer with 8 hr per day average service. The reducer will then have a speed ratio of 1750:100, or 17.5:1. This will require a double-reduction unit, except in a compound-planetary type which is a special design of double-reduction unit.

Single-reduction non-planetary units are built for standard ratios of 1.75:1 to 10:1; double-reductions from 10:1 to 70:1 and triple reductions from 70:1 to 325:1. For single-reduction planetary units speed ratios range from 4:1 to 11:1; double reductions from 22:1 to 120:1; triple reductions from 120:1 to 1200:1; and compound units from 11:1 to 22:1.

Gear Selection

In the data sheet (page 118) a gear service factor of 1.25 is used for a motor-driven heavy-duty belt conveyor operating 8 to 10 hr per day. To get the capacity of the gear unit required for the load multiply the motor horsepower by the service factor, or 25x1.25 = 31.25 hp. This means that a 31.25-hp gear will be used to connect the 25-hp motor to its load.

When the power required to drive the load is not accurately known, select the reducer on the basis of power-unit horsepower as in the preceding paragraph. For many applications the power required may vary widely. On a belt conveyor, heavy loading, lack of lubrication and maintenance of the idler and other conditions around the conveyor may increase power consumption 25% or more above that required for good operation. The same is true of long rotating kilns, because of misalignment.

Loading of other machines is controlled by an operator who is likely to know no limit but the motor capacity. Therefore, the only safe guide when selecting a gear or other mechanical power-transmission unit for such applications is motor capacity. A little excess capacity in a gear speed reducer always pays dividends in longer life and lower maintenance costs.

Where possible the gear unit should be coupled directly to its power unit and load. When this cannot be done the overhung load caused by the belt, chain drive or pinion must be calculated. Because the head shaft on some conveyors operates at slow speed the output shaft of the gear unit is connected to it by a roller chain.

Assume that the conveyor head shaft in the previous problem operates at 25 instead of 100 rpm and that it was decided to connect the 100-rpm shaft of the gear to the conveyor head shaft by a chain drive with a 20-in. sprocket on the gear output shaft. The tangential pull of the chain on this shaft may be found by the formula:

$$P = \frac{63{,}000 \times Hp}{S \times R}$$

where P is the tangential pull of the chain at the pitch-circle radius of the sprocket, Hp the selected horsepower of the gear, S the output-shaft rpm and R the pitch-circle radius of the sprocket. In our problem $Hp = 31.25$, $S = 100$ rpm and $R = 20 \div 2 = 10$ in. Then, the tangential pull on the output shaft of the gear is:

$$P = \frac{63.000 \times 31.25}{100 \times 10} = 1969 \text{ lb.}$$

This formula also can be used to find the tangential load for gears and belts

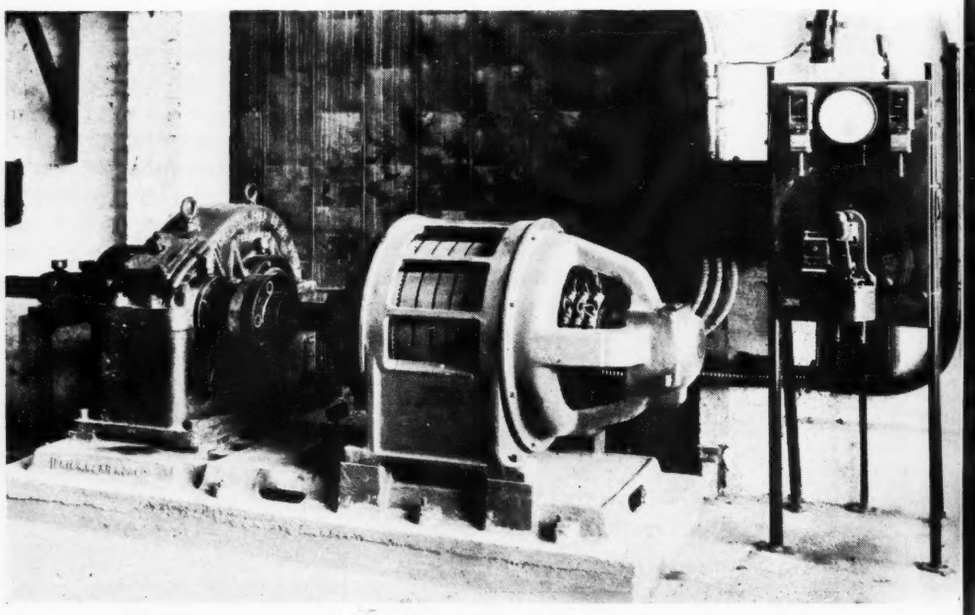


Fig. 5—A 150-rpm wound rotor alternating-current motor drives a line shaft in an asphalt plant at 250 rpm through a herringbone-gear speed-reducer unit

by multiplying the result obtained with it by 1.25 for gears, 1.5 for V-belts and 2.5 for flat belts.

Overhung Loads

Gear manufacturers list the overhung loads that their units can carry. If these are to be exceeded, an outboard bearing must be installed. To take care of the conveyor drive previously noted we need a double-reduction, spur, helical, herringbone or compound-planetary gear unit with an input speed of 1750 rpm and an output speed of 100 rmp, rated 31.25 hp for an overhung load of 1969 lb. The catalog unit that comes nearest to meeting our specifications is one rated 31.3 hp with a speed ratio of 18:1 and good for an overhung load on the output shaft of 3450 lb. If the speed ratio must be exact, then this may be had at about 8% increase in cost. This unit would operate within satisfactory temperature limits with self-lubricated gears. With high-speed input shafts, particularly for units 35 hp and above, a circulating-oil system is frequently required to keep gear temperatures within safe limits. For units over 200 hp an oil cooler may also be needed.

The procedure for selecting gearmotors is simpler than for separate gear speed reducers. Since the motor and gear are built as a complete unit they must be considered more as a motor than as a speed reducer. For shock loads the motor horsepower will not be increased, since it is selected according to average requirements, but the gear capacity should be greater.

Gearmotors are therefore built in three AGMA standard classes. Class 1 units are designed for 8-hr service driving a uniform load; class 2 units have gears that are good for either 24-hr uniform loads or 8-hr moderate-shock loads; class 3 units are designed with gears for either 24-hr moderate-shock loads or 8-hr heavy-shock loads. These class numbers are given in the two right-hand columns of the data sheet, page 118, for a wide variety of load applications.

Selection Procedure

Assume that we are to select a 25-hp gearmotor for the heavy-duty conveyor in our previous problem. Referring to the data sheet, we find that a No. 2 gearmotor is recommended for this service, for either 8- or 24-hr operation. Gearmotors are built for 100 rpm standard output speed (see table).

Where there is danger of the driven machine jamming or greatly overloading the gearmotor, a planetary gear, known as a planetorque, may be used. This unit includes an overload device to protect both the gears and the motor, Fig. 4. The gearing is standard, except that the ring gear is held by a lug *L* instead of being keyed in the housing bore. This lug rests against two spring-loaded plungers *P* and engages two switch rods *R*. Springs *S* are preloaded a fixed amount by the adjusting screws *A*, and held to that adjustment by lock nuts.

At normal loads the pressure of the lug against the spring plungers is less than the spring tension and the unit operates normally. If an overload occurs either gradually or suddenly, the loaded spring compresses and the movement of the ring-gear lug operates the control switch to stop the motors. Cutoff action is practically instantaneous, since a few thousandths of an inch movement of the ring gear opens the cutoff switches, after which the ring gear can overtravel about 0.25 in. to help cushion the shock of the load.

Many drives, especially those requiring overload protection, have a high starting torque. To start up at high torque, the starting button, while it is held down, automatically shorts out the planetorque switches. When the button is released the switches become operative.

This method of protection acts instantly since it is actuated mechanically by the overload and can be set to close tolerances. Then it automatically resets itself when the overload is removed and does not tie up production. Shear pins not only require time to replace, but the actual point of load release is subject to error caused by factors that cannot be controlled.

After deciding upon a unit of correct capacity and input and output speeds, the next problem is to select which gear, whether helical, herringbone, worm gear, planetary, etc to use. This decision should be based on an understanding of the inherent properties of each type of gearing, their cost and other factors. This will be the subject of the next article.

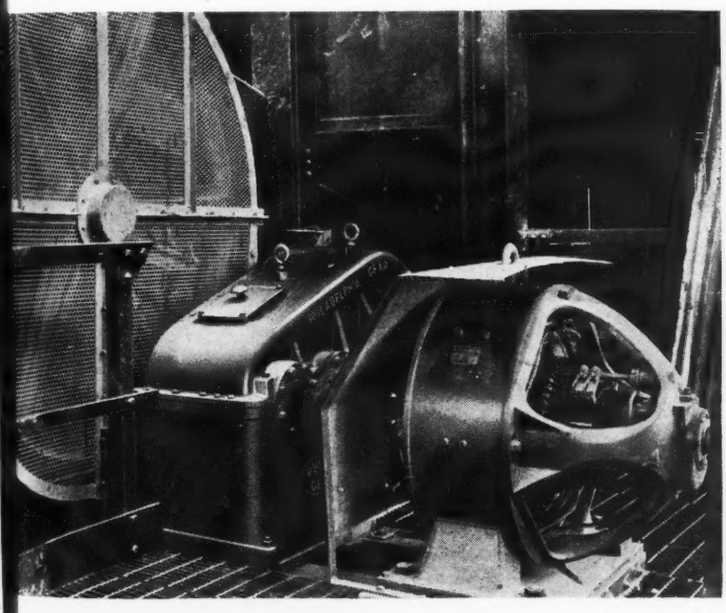


Fig. 6—Double-reduction herringbone-gear speed reducer with 25:1 speed ratio connects 75-hp, 870-rpm dc motor to feeder

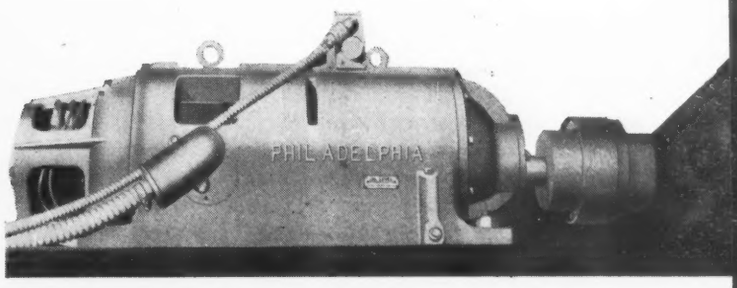


Fig. 7—A 15- and 7.5-hp, 1150- and 575-rpm slip-ring planetorque gearmotor drives a coal conveyor at 63 and 31.5 rpm

AGMA Standard Output Speeds For Gearmotors, rpm

1430[1]	1170[1]	950[1]	789[1]	640[1]	520	420	350	280	230	190	155	125	100	84	68
56	45	37	30	25	20	16.5	13.5	11.0	9.0	7.5	6.0	5.0	4.0		

[1] These speeds not obtainable with planetary gearing and 1750-rpm motors

NO MORE STRAITS TIN . .

▶ *In 1938 the countries now known as the United Nations produced 90.6% of the world's tin ore, measured in terms of its tin content. Today, the Jap conquests in the Straits Settlements and Malaya have driven that figure down to 26.8%, while the Axis percentage has risen spectacularly from 9.4 to 73.2*

That's why America must change her packaging habits — stop canning dog food and tobacco in tinned steel, stop making tin foil for chewing gum, etc. From now on tin use must not be permitted where any substitute can fill the bill with any degree of success.

This applies to bearing babbitts and bronzes. Babbitts, in particular, are due for drastic restrictions. Power engineers must find ways to get along with fewer pounds of babbitt containing less tin in each pound. Yet they must keep essential machines running on these wartime bearings. How can it be done?

Here are the answers of an outstanding group of specialists in the field of bearings and alloys. See page 91 for additional information on bearings.

See also letter "Here's Why You Can't Have Tin," page 114, for a good picture of the world tin situation.

ALBERT B WILLI

Chief Engineer, Federal-Mogul Corporation

Considering only the angle of tin-base babbitts, the primary problem is to provide a substitute composed of available materials. Lead-base babbitts are the natural substitutes insofar as metal availability is concerned. However, the past history of lead-base babbitts is rather unpromising when any wholesale substitution is considered.

Tin-base babbitts are currently used in all conceivable applications. These involve:

1—Babbitt thicknesses as heavy as 3/8 in. or more.

2—Babbitt thicknesses as thin as 0.002 in.

3—Cast-iron backs or housings, with cast or machined anchorages and no chemical bond.

4—Bronze backs or housings, with cast or machined anchorages and no chemical bond.

5—Bronze backs or housings with a chemical bond.

6—Steel backs with a chemical bond.

7—Adequate pressure lubrication.

8—Scanty lubrication—drop-feed oilers, wick-feed, ring-oiled.

9—Light and heavy loads.

10—Constant load, intermittent load and load reversals.

11—Slow and high-speed shafts.

12—Large and small shaft diameters.

13—Rotating, oscillating or sliding shafts.

14—Presence of acids, corrosive liquids, dust and fumes.

15—Babbitt applied by gravity pouring or centrifugal casting.

To meet all of these conditions successfully, a number of tin-base babbitt compositions are required.

The development of lead-base babbitts has progressed side by side with the tin-base. The substitution of lead-base for tin-base has always been economically desirable because of the cost differential, but lead-base babbitts have many individual characteristics and properties that are considerably different. If there were not these pitfalls, lead-base babbitts would have replaced tin-base long ago.

I do not think it is possible to substitute *any* lead base babbitt arbitrarily for *any* tin base (without certain associated changes) and obtain comparative performance.

Under certain specified conditions, it is possible to make this substitution, with perhaps some changes, and obtain *improved* performance. An example of this is in automotive-engine main connecting-rod and cam bearings. In the last couple of years a number of builders have replaced tin-base babbitt bearings by lead-base.

We have done a lot of work with lead-base babbitts. The results as applied to gasoline- and diesel-engine bearings have been very pleasing.

Much work along this line is being carried on at this time by various agencies, but I am inclined to think it is a little early to have all the answers.

R L HALLETT

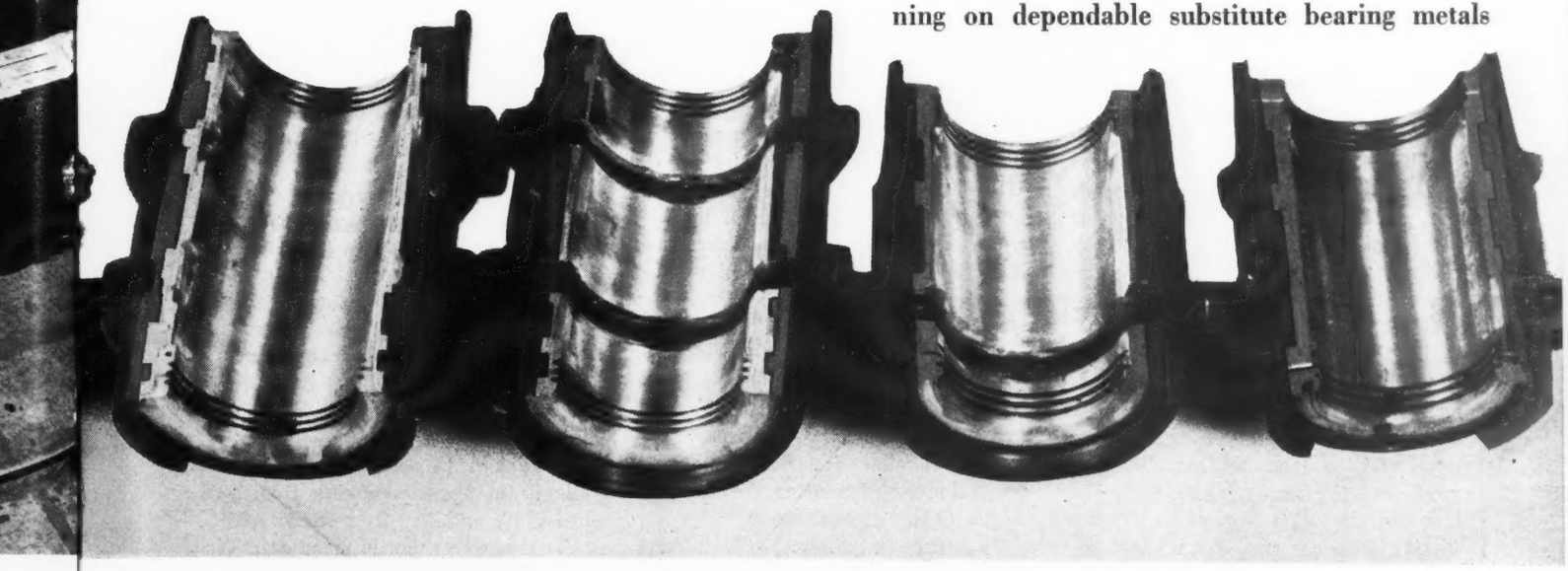
Chief Chemist, National Lead Co

Bearing metals are frequently known as babbitt metals, because of the original work done in this field by Isaac Babbitt.

Bearing alloys may be roughly classified as tin-base bearing metals containing a high percentage of tin with small amounts of copper and antimony and no lead, and lead-base bearing metals with a high percentage of lead, mod-

. FOR YOUR BEARINGS

With the Axis holding 73% of world's tin ore production, these alloy specialists show how to keep America's war-production machines running on dependable substitute bearing metals



erate amounts of tin and antimony and a small amount of copper.

The required characteristics of bearing metals are adequate strength to resist pressure, sufficient malleability to conform to irregularities in shape or alignment of rotating shafts, and ability to return to smooth surfaces after being cut or roughened.

Other desired characteristics are low friction coefficient, relatively high melting and softening points and ability to resist corrosive action of acids which may form in the lubricating oils at elevated temperatures.

The tin-base bearing metals are in general most satisfactory and are somewhat superior for bearings subjected to heavy loads and high speeds, but properly formulated lead-base bearing metals are satisfactory for many bearing purposes and in times of emergency may be substituted for tin-base bearing metals with only slight decrease in length of service even for heavy-load and high-speed conditions. Of course, lead-base bearing metals are entirely satisfactory for low speeds and light loads.

At the present time the tin shortage makes it imperative to conserve tin in every possible legitimate way. Except for some special requirements, lead-base metals may be used quite generally for bearings of nearly all types.

The best grade of tin-base bearing metals contain upward of 85% of tin and excellent lead-base bearing metals, developing the best characteristics of the lead-base alloys, can be made with not to exceed 10% of tin.

CARL E SWARTZ

Cleveland Graphite Bronze Company

In the present tin shortage we are fortunate in having some lead-base bearing alloys that have been extensively tested in laboratory and field—alloys that may be considered as makeshift substitutions now, but will not be readily supplanted when tin again becomes plentiful. One of these contains 1% arsenic, 1% tin, 15% antimony, 0.5% copper and the remainder lead.

Many good lead-base alloys have been used in past years, but the somewhat greater skill required in casting these into bearings has resulted in the use of tin babbitts even at greater cost. Lead-base alloys dross more easily and should be cast at higher temperature. They segregate somewhat faster than the tin-babbitts. The lead-base alloy suggested above seems to be less subject to these faults than alloys developed earlier.

A chemical bond supports the bearing much better than a mechanical bond.

Experience has shown that thin linings perform just as well as thick ones and that the ultra-thin bearings perform better. Therefore make the casting no thicker than necessary to take care of the fitting of the bearing and amount of wear allowable before the bearing must be replaced. For the most part, bearings thicker than this minimum merely tie up metal that could serve a more useful purpose.

To sum up the points covered, experience in bearings for heavy machinery seems to indicate that a bearing properly made using a less satisfactory alloy is likely to outlast one carelessly made with the best bearing alloy available. A chemical bond is superior to a mechanical one. When the bearing is subjected to vibration and pounding, a bearing lining chemically bonded to the backing will last longer. A thin liner is as good as a thick one—and in very thin layers superior to a thick one.

G B KARELITZ

Professor, Department of Mechanical Engineering, Columbia University

The desire to reduce tin in babbitts for metalling bearings has been with us always, tin being an expensive metal. This desire has been stronger during the last two years when it became not only expensive but strategic.

Lead-base babbitts, such as SAE No. 13 or 14, are suitable for most bearings where the loads are moderate, uniform. They are used advantageously in commercial electric motors, for instance.

Where the service is more severe, temperature high, or where loss of a bearing would be a serious matter, as in turbines, speed reducers and air compressors, tin-base babbitt, of composition similar to SAE No. 10, 110, 11, has been used. The main features of these babbitts are: adequate strength against fatigue and cracking at normal temperatures of, say, 160 F and loads up to, say, 200 psi; gentle wiping of the metal in case of occasional instantaneous stoppage of lubrication or dirt getting into the bearings; comfortable handling when remetalling.

In the early twenties, the Atchison, Topeka & Santa Fe Railroad tested a bearing material consisting of 98% lead, with 2% hardener. Simultaneously, a similar metal appeared in Germany under the name of *Bahnmetall* (railroad metal).

The American metal is sold now under the name of *Satco*. The Canadian National Railway has been using a similar babbitt. The strength of this metal is as good as that of the tin-base metal. For most applications in the power plant there seems to be no reason why it cannot replace tin-base babbitt satisfactorily.

Of course, there are several drawbacks. It may be well not to re-use metal melted out of a bearing when remetalling the shell. New metal should be used, since repetitive remelts of the metal may burn out the hardening ingredients (tin, mercury, calcium), unless care is taken to avoid excessive stirring and to guard against contamination of the alloy with babbitt and other foreign metals.

Another thing to remember when using Satco metal is that its pouring temperature is considerably higher than that of the tin-base babbitt. (It does not wipe until the bearing reaches a temperature much higher than the wiping temperature of tin-base babbitt).

Tin-base babbitt should be poured at 600-700 F, that is, it should be heated in the pot to, say, 800 F to allow for cooling in the ladle. The shell should be kept at nearly 200 F, to avoid chilling the poured lining.

Satco metal should be poured at 800–900 F, or heated in the pot to 1000–1100 F and the shell should be heated to about 350 F. Also, the viscosity of liquid high-lead metal is lower than that of tin-base babbitt. This calls for ways to prevent the metal from running out of the shell. A cast-iron core with a plate under the shell is sufficient for tin-base babbitt, but for Satco metal the joint must be protected by well-fitted side strips or by clay or similar material. Otherwise, the technique of pouring the bearings is practically the same.

Of course, tin-base babbitt is the king of bearing metals, but this is war and we must forego luxury. The writer would not be surprised to find that the "high-lead" bearing metals will find favor with mechanics and engineers.

The high-lead bearing metals may prove more resistive to acid oil than tin-base babbitt. It may be therefore advisable to use "inhibited" oils, resisting oxidation; oil companies are now marketing such oils. However, these oils need not be employed unless the bearings really begin to show signs of corrosion, which depends to a large extent on the service of the individual machine.

JAMES I CLOWER
Assoc. Prof. of Machine Design, Virginia Polytechnic Institute

The Society of Automotive Engineers has standardized five babbitt metals, designated as SAE 10, SAE 110, SAE 11, SAE 13 and SAE 14. No. 10, 110 and 11 are high-tin, low-lead babbitts, tin content ranging from 86 to 90%. No. 13 and 14 are low-tin, high-lead alloys, tin content ranging from 9.25 to 10.75% and lead from 75.25 to 86%.

Thus it seems that in many cases No. 12 and 13 babbitts might be substituted for No. 10, 110 and 11, and a substantial reduction in tin realized. In many cases this would mean shorter bearing life, of course, but not necessarily at greater expense as high-tin alloys cost

Field of Usefulness of Various Bearing Metals

Bearing Metal	Max. unit pressure, psi	Minimum Zn/P (1)	Maximum PV (2)	Max. oil reservoir temp, F	Minimum journal hardness, Brinell	Corrosion
Tin-base babbitt Copper 3.50 Antimony 7.50 Tin 89.00 Lead (max.) 0.25	1000	20	35,000	235	Not important	No
Lead-base babbitt Tin 5–7 Antimony 9–11 Lead 82–86 Copper (max.) 0.25	1800	10	40,000	225	Not important	No
Cadmium-silver-copper Silver 0.75 Copper 0.50 Cadmium 98.75	1800–3850	3.75	90,000 and over	260	250	Not likely if specified temp is maintained and proper lube oil is used
Copper-lead Copper 35.00 Lead 65.00	Over 1800	3.75	90,000 and over	260	300	Same as above

Compiled as a guide for automobile engine design (1) Z = absolute viscosity of oil at operating temperature, n = rpm of journal, P = maximum total load on bearing (2) V = peripheral velocity of journal, fpm

about 100% more than high-lead metals.

Undoubtedly many tin-base bearing linings could be replaced with a tin-free alloy without any sacrifice in life or increase in friction losses. In some cases, the tin-free alloy may prove better. In recent years a number of new alloys have been developed. For some conditions these are superior to babbitt.

Undoubtedly many bearings, particularly on old equipment, were lined with babbitt because that was the best material available. Others may have been lined with babbitt simply because the manufacturer knew how to handle babbitt, or found it cheaper.

It is risky business to replace high-tin babbitts with either a low-tin lead babbitt or with a tin-free alloy without giving careful consideration to the differences in the alloy characteristics. To be safe, one must be thoroughly familiar with the properties of each alloy, know fully their limitations as to temperature and pressure.

In this connection the table (page 76) may be of value as a general guide for substituting both low-tin-high-lead and tin-free alloys for high-tin babbitts. For a more complete survey of the field of usefulness of these alloys reference should be made to "Handbook of Sleeve Bearings" by Albert B Willi, published by Federal-Mogul Corp, in which this table appears.

In general it may be said tin hardens the alloy and increases the compressive strength, whereas lead increases the plasticity and decreases the compressive strength. It is a popular belief that tin-base babbitts are more able to resist shock than lead-base babbitts. It has been noted, however, that under certain conditions some lead-base babbitts proved better than the tin-base ones. The popular prejudice against lead-base babbitts is probably caused by the fact that lead-base babbitts are more critical as to pouring temperature, tinning, heating of the mandrel and shell and presence of other alloys and impurities.

It has been proved that lead-base alloys have better anti-friction properties than tin-base alloys. They are much cheaper per pound, but weigh about 40% more than tin-base metals.

Antimony, in both tin- and lead-base babbitts, reduces shrinkage, increases hardness, but causes brittleness. To decrease the plasticity of lead-base alloys, more antimony is used (9 to 15%) than in tin-base metals (4 to 7%). Copper adds toughness and hardness but does not alloy well with lead. Consequently, the percentage of copper used in lead-base alloys should be less than 0.5.

Successful operation has been reported for heavily loaded bearings of a high-lead alloy (96 to 97%) hardened by alkali earths such as sodium.

In general it is unwise to attempt to mix one's own alloy. It is best to give all facts to a reliable alloy manufacturer and ask for his recommendations.

H W Gillett
Metallurgist, Battelle Memorial Institute

A very thin layer of babbitt supported by a stronger, less-plastic backing, such as steel, is much stronger than a thick layer. This makes a thin layer of ordinary lead babbitt the engineering equivalent of a thick tin-base babbitt for many applications. Where the alignment requires thick linings to give finish without danger of cutting through to the backing, or where old bearings designed for thick tin-base linings are to be relined, the reinforcement that comes with extreme thinness is lacking, so a babbitt with the properties of tin-base is required.

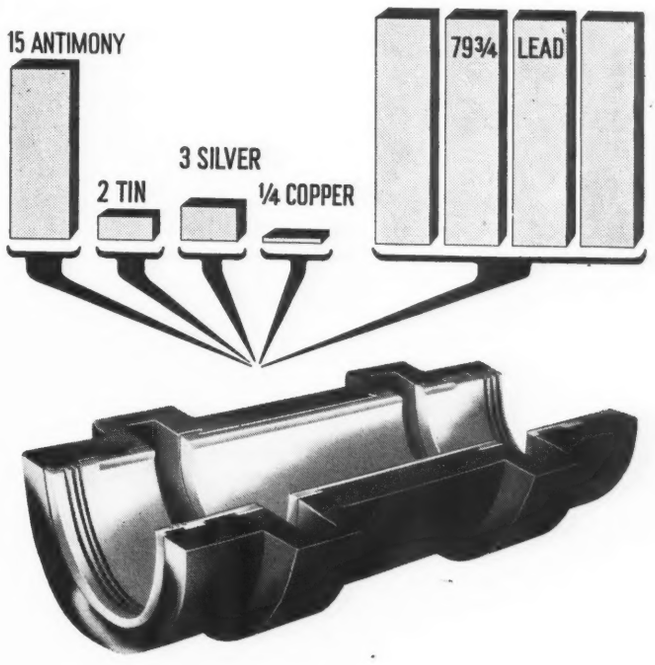
To meet this the strength of lead-base needs improvement, especially at operating temperature. To retain embeddability for grit, it is not advisable to raise the room-temperature hardness too far above that of tin-base. The bonding properties of lead-base also need improvement.

Silver raises the high-temperature strength of lead-base babbitt, and greatly increases bonding properties. It will be remembered that lead-silver is a very useful solder with exceptional high-temperature strength.

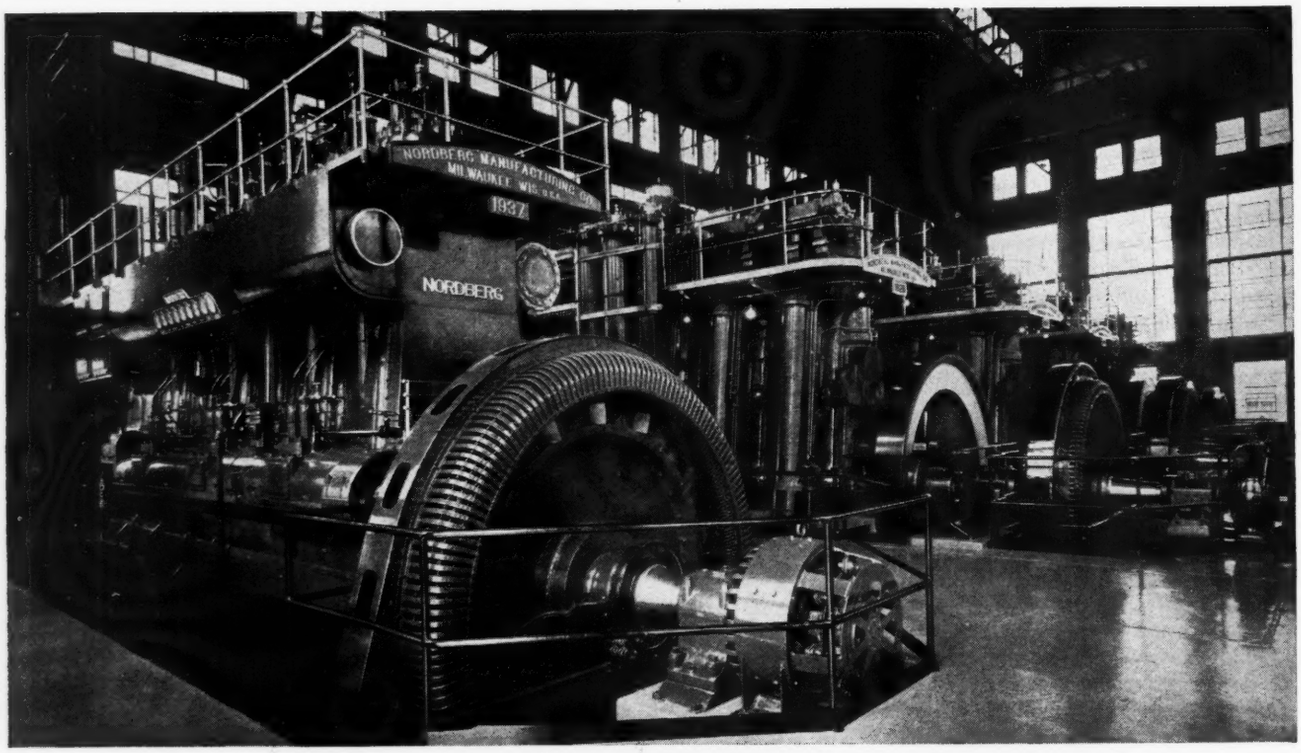
By adding from 2 to 5% silver to ASTM lead-base babbitt No. 10 and retaining the 2% tin content to give corrosion resistance against acid or oxidized oil, a medium babbitt of 15 antimony, 2 tin, 3 silver, ¼ copper, balance lead, is produced whose temperature-hardness curve duplicates that of a medium tin-base babbitt. Harder or softer babbitts may be secured by adjusting silver content up or down.

This is a close duplicate to tin-base babbitts with 80 to 90% tin in mechanical, bearing and bonding properties.

BATTELLE'S ANSWER:



This tested formula is Battelle Institute property, but licensed without charge for wartime use by qualified babbitt makers and users—Editor



The 2250-hp engine installed in 1937 and the four 1250-hp units placed in service between 1924 and 1928

Ponca City Diesels Average 7 Mills per Kwhr for Ten Years

Recently released 10-year operating statement reveals outstanding performance of 7250-hp municipal electric plant

▶ THE MUNICIPAL ELECTRIC PLANT at Ponca City, Oklahoma, boasts an outstanding performance record and is properly regarded as one of the foremost diesel-engine power plants in the country. For several years it has ranked among the diesel plants having the lowest total production cost per net kilowatt-hour.

Ponca City traces its beginnings to the opening of the "Cherokee Strip" in 1893 and was incorporated in 1899. A municipally owned water system was established in 1902, and in 1912 steam-electric generating equipment was installed to provide service for the city.

The discovery and subsequent development of important oil fields and the construction of two large oil refineries and other commercial enterprises in the immediate vicinity resulted in rapid growth of the city and greatly increased the demands for electric service. The original steam plant was expanded on several occasions to meet the growing load, but in 1923 it became necessary to install additional generating capacity and to reconsider the power situation from the viewpoint of the city's probable future growth. This also presented an opportunity to analyze the over-all economies possible by the continued use of steam and the installation of steam-generating equipment of modern design as compared with diesel engines which were, by this time, well established as thoroughly reliable and economical prime movers for central-station service.

Ponca City—Ten-Year Operating

Year	Generation, kwhr	Operating Income	Operating Expense		
			Production	Production Cost, cents kwhr	Distribution
1932.....	8,766,800	$289,371.68	$69,365.43	.79	$47,423.50
1933.....	8,537,900	279,826.90	65,682.33	.77	43,097.29
1934.....	9,161,800	291,185.74	71,346.81	.78	44,903.81
1935.....	9,637,400	311,744.64	73,624.79	.76	50,481.54
1936.....	10,115,500	326,797.35	69,689.10	.69	48,977.60
1937.....	11,017,400	346,374.45	71,444.95	.65	49,724.22
1938.....	11,247,585	363,853.42	73,604.20	.65	47,803.33
1939.....	11,656,000	373,159.11	79,295.02	.68	45,110.93
1940.....	11,955,300	369,515.15	80,746.56	.68	46,573.70
1941.....	12,224,000	392,721.31	82,674.86	.68	45,716.86

Erected in 1928 to provide for future expansion, this building now houses 7250 hp in diesel generating capacity, comprising four 1250-hp and one 2250-hp engines

A thorough investigation of steam and diesel generation led to the installation of a 1250-hp Nordberg engine and, within two years (1926), of a duplicate. Growth of the city and electric load continued, but at a much higher rate than had been anticipated, so it was decided to build a new plant at a site better suited to future expansion.

The new plant was built in 1928 when two additional Nordberg diesels were ordered and installed and the two older engines moved to the new site. The new plant went into service with a total capacity of 5000 hp. These four units constituted the sum total of the city's generating capacity for the next nine years and were frequently operated at overloads until a fifth Nordberg diesel of 2250 hp was installed in 1937.

The table sets forth the official operating statement published by the city for the 10-year period ending June 30, 1941. The item *Operating Production Expense* includes fuel and lubricating oil, salaries, all maintenance expenses on engines, auxiliaries and building, insurance, water, light, heat and depreciation. See POWER, May, 1938, pg 56 for a complete 10-year analysis of maintenance and other operating data.

The electric plant and transmission system represents an investment of $1,309,790.00 and has an appraised value of $907,105.00.

Two salient features in the operating record of this plant are the use of heavy fuel oil (8–10 deg API) and the 18-year performance of the original engine. Since 1924, this unit has generated a total of 44,140,070 kwhr, or an average of 2,452,670 kwhr per year. During the past four years the average generation rose to 4,360,145 kwhr. Over this same period, maintenance cost for the engines has averaged less than $.60 per installed hp per year, a figure considerably below the average maintenance cost of diesel engines throughout the country.

Three commissioners, a city manager and a general superintendent govern Ponca City and manage its utilities. The city manager, L A Cann, has held his present position for many years and is largely responsible for the splendid condition of the city's affairs. Patrick Schlesinger, general superintendent of municipal utilities, is known as one of the country's outstanding operators, as attested by the record he has established for operating efficiency, low production cost, the general condition of his power plant, and electrical- and water-distribution systems.

Statement Period Ending June 30, 1941

Operating Expense	Net Operating Income	Financial Expense	Net Profit
Total			
$116,788.93	$172,582.75	$20,204.26	$153,378.49
108,779.62	171,047.28	16,222.34	154,834.94
116,250.62	174,935.12	12,371.28	162,563.84
124,106.33	187,638.31	7,394.98	180,243.33
118,666.70	208,130.65	12,290.75	195,839.90
121,169.17	225,205.28	14,300.35	210,904.73
121,407.53	242,445.89	18,033.79	224,412.10
124,405.95	248,753.16	16,134.73	232,618.43
127,320.26	242,194.89	15,854.34	226,340.55
128,391.72	264,329.59	16,053.74	248,275.74

✦ ✦ ✦

Examine all Valves before Entering Idle Boiler in Battery

A recent accident report shows the need for examining all boiler valves before entering any idle boiler that is connected in battery to others under steam pressure.

After a new bent-tube boiler had been erected in an existing battery and connected to its piping system, tube ends at the bottom drum leaked during hydrostatic test. The boiler was drained and the following morning an erector entered the drum and started re-rolling the tubes.

A fireman decided to blow down one of the existing boilers, but before opening the valves he asked and obtained permission to do so. After he had opened the blowoff valve, he noticed steam coming out of the mud-drum manhole of the idle boiler and closed the valve immediately. The man in the mud drum shouted and got out as quickly as possible but was seriously burned and required hospitalization.

The blowoff valve for the boiler being erected had been left open after the boiler was drained and the hot-water and steam backed up through the blowoff line.—*The Locomotive*

Maximum Output From Existing Boilers

▶ STATIONS NOW OPERATING must supply nearly all of the power needed to see us through this war, as steel and other metals are more urgently required for ships, fighting equipment, ammunition, and oil refineries.

Power plants formerly operating with comfortable capacity factors probably will be stepped up close to, or beyond, the 100% mark. This means intelligent inspection, repair and operation.

The most frequent forced outages of boiler units are those caused by tube failures or leaks at tube seats or handhole fittings. Some of the more frequent causes for such failures are:

1. Improper feedwater treatment
2. Faulty boiler or waterwall circulation
3. Priming or carryover to superheater and turbine
4. Leaks caused by thermal stresses resulting from too-rapid temperature changes
5. Corrosion or tube wastage, internal or external
6. Cutting of tubes by soot blowers
7. Low water.

Progress in feedwater treatment to prevent tube losses has been substantial. Many plants now operate for years without losing a single tube, and some without any internal cleaning despite higher pressures and rates of heat input. Yet today there are more outages from tube losses, scale and sludge than from any other cause. With the urge to keep boilers operating at higher outputs and for longer periods between scheduled outages for inspection and cleaning, forced outages due to inadequate feedwater treatment are likely to increase.

Some of the causes for tube losses resulting from imperfect feed-water treatment are:

(a) Over-confidence that feedwater treatment is entirely correct because of continued satisfactory operation with no tube losses. The cumulative effect of anything short of 100% will ultimately lead to tube losses unless inspection and remedy correct the situation in time.

(b) A sudden change in water conditions caused by condenser leakage, effect of dry weather on supply, or one of many other causes, with the difficulty of promptly changing the treatment to the exact degree required

(c) Careless or ignorant treatment

(d) Divided responsibility, where a consultant is held responsible, and yet is dependent upon the accurate and conscientious checks of the operating force. Sometimes even the prescription is not entirely correct. Another phase of divided responsibility arises when inadequate boiler circulation is injected into the problem as the presumed cause of tube failures. This may or may not be justified.

Competence in feedwater treatment is essential. Some operating companies have thoroughly competent chemists and laboratory facilities for satisfactory feedwater analysis and treatment, with perhaps occasional consulting service from one of the several experts in this field. The majority of operating companies employ consultants on a yearly basis with good results.

There has been and still is faulty or inadequate circulation in some boilers and in some arrangements of water walls. The later units of all manufacturers are more nearly, if not entirely, free from this fault. Circulation has often been erroneously accused of tube losses caused by scale or sludge. It is now believed that many changes to amplify circulation were unjustifiably demanded by operators. In any event, the tendency has been to bring about ample, or even surplus circulation.

There is no need to deny, however, that there are boilers in operation today, mostly of the older vintage, with limitations in circulation that prevent an increase in output beyond the point where the boiler can be operated reliably and free from the liability of emergency outages. The manufacturer should be consulted about increasing the output of such boilers.

This is the kind of problem where mutual cooperation can produce real results on existing units by either getting more output, or discouraging the operator from trying to get more where the attempt might lead to trouble.

Many older boilers are limited in output because of high moisture or carryover with the steam. This may cause deposits in and loss of superheater tubes, or, if carried to the turbine, reduction in output or loss of time for washing or cleaning, depending upon the nature of deposits and difficulty of removal.

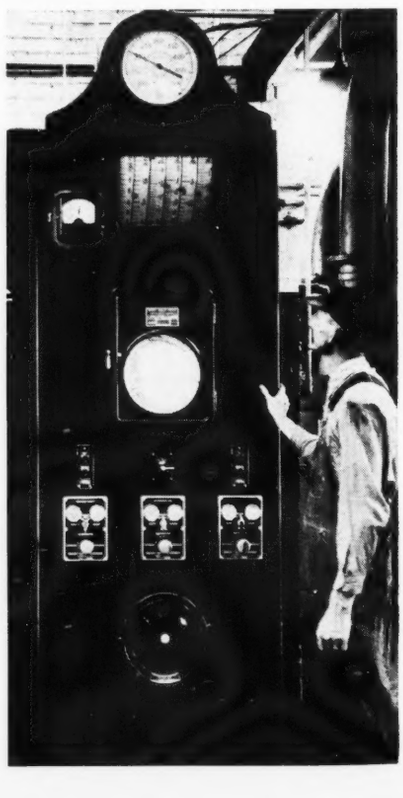
Great progress has been made in steam separation and often this new equipment is well adapted to existing boiler plants.

Boiler outage is sometimes occasioned by too-rapid temperature changes, especially with the higher-pressure units having relatively thick drums, headers, tubes, etc. The best remedy is a proper schedule for bringing boilers on and off the line, guarding against slugs of water through superheaters, water hammer in economizers, etc. Sometimes seal-welding of tubes at seats, and other adaptations of modern boiler-construction practice are justifiable.

While not generally found in a large number of plants, corrosion and tube wastage have caused some very serious outages and output losses.

Internal corrosion may be more insidious and serious than a simple problem of feedwater treatment. Some tubes have been seriously corroded in local areas most difficult to find until failure occurred. The presence of copper, or other unusual conditions may contribute to this trouble. An occasional plant still fails to heat the feedwater to 212 F and deaerate it, with the result that corro-

For best results meters, instruments and controls should be systematically checked and adjusted



*Slightly condensed from a paper presented April 9 at the Midwest Power Conference, Chicago. Conference report will appear in June POWER.

E G Bailey, vice-president of Babcock & Wilcox, is internationally known for his pioneer work in the fields of boilers, combustion, and instrumentation

Power equipment already installed must bear the brunt of war loads. E G Bailey shows how to increase boiler capacity and reduce outages*

sion or pitting takes place somewhere within the unit.

External wastage has been encountered in a few furnace-wall tubes in the past seven or eight years, but only recently to a serious degree. While the entire cause and remedy have not yet been found, the wastage seems to be restricted to bare tubes in zones close to flame from burners where there is almost complete absence of oxygen in the furnace gases at the area of attack. Furnace tubes in such areas should be carefully inspected. If any wastage has taken place, steps should be immediately taken to stop it, else tube losses will occur and serious outage result. High outputs and scale or sludge in the tubes seem to accelerate such outside wastage.

Another form of corrosion familiar to all is that occurring in economizers or air heaters when flue gases are reduced to a temperature below the dewpoint. This is likely to decrease with higher outputs, but should not be forgotten where older boilers are brought into service for standby or emergency use at variable or relatively low rates.

Occasionally, jets of steam from soot blowers cut tubes in boilers, superheaters, and economizers, causing outage. Blowers should be properly installed to forestall such cutting, but inspection at each opportunity is the surest prevention, as incipient cutting or polishing of tubes can be detected and remedied well in advance of any failure.

With apologies is this subject even mentioned, but some of the oldest sins and neglects of the human race still persist, and this is one of them.

Many operators may encounter more new problems and need more help on fuel than on feedwater and the boiler itself, because many have already or will have to convert from gas or oil to coal. Others may have to change from their present coal to a new or a variable coal which may not be so good. Those having to use a variety of kinds of coal should follow its analysis closely and perhaps accomplish some good results by properly mixing or blending.

A little carelessness in lighting a furnace may cause serious damage to life and property, and a long and expensive boiler or plant outage. While this may seem just as elementary as low water, I make no apologies for mentioning it because disastrous furnace explosions still occur more often than seems excusable. The frequency and damage are greatest with gas and oil. Next comes pulverized coal. Here the trouble is often with the gas or oil lighting-torch system, but occasionally arises from the coal itself. Explosions seldom occur in stoker or hand-fired boiler furnaces, although occasionally gas is generated in such quantities that dead pockets form and ignite.

Detailed instructions on preventing furnace explosions will not be given here. Electric eyes, interlocks and protective devices are rapidly being perfected to a high degree of reliability and usefulness in this particular. With or without them, intelligent care is needed at all times.

Stokers need maintenance. The best way to attain the maximum output and prevent unscheduled outage from breakdown or burned-out parts is to inspect and repair as needed. Uniform firing prolongs the life of grates and tuyeres.

The first step toward maximum output and reliability of pulverizers and feeders is to keep tramp iron, wood, and other foreign matter, as well as oversized coal, out of the feeder. Crushers should be kept in good condition, and used on all coal over ¾-in. screen.

The pulverizer wearing parts must be periodically and properly adjusted and replaced. Shortage of certain alloys may force use of materials having shorter life, therefore requiring more checking and replacements. Machinery of this kind needs proper lubrication and bearing and gear adjustment.

Unduly wet coal gives a great deal of trouble, especially in getting it from the bunkers to the pulverizers. Trouble in the pulverizer can usually be obviated if amply hot primary air is available and properly used.

The need for periodic check on wear of exhausters by coal and perhaps on induced-draft fans by flyash and cinders should not be overlooked. Some fans have been neglected to the point where they flew to pieces. Any pipe carrying coal in raw or pulverized form is subject to some wear, especially at bends. A stitch in time saves an outage.

Not everyone fully realizes how much progress has been made in perfecting designs of steam generating units to burn low-grade coals successfully. Many plant operators will probably be well repaid during the next few years for their foresight in selecting equipment of advanced design.

Many installations of the older or more limited design will face difficult problems from ash and slag, as ratings are increased or coal of less adaptable characteristics must be burned. Detailed discussion of methods to prevent or minimize trouble from clinkers and slag is out of place here because of the space available and the multiplicity of conditions with the large varieties of equipment and fuels. However, a few general suggestions are pertinent:

In fuel beds, much trouble from clinker can be avoided by maintaining uniform and relatively thin fuel beds with equalized air distribution. Zones of excessive *reducing condition*, which result in more fluid and troublesome clinker, especially with coal ash high in iron, should be avoided.

Pulverized-coal-fired furnaces perform better in every way when the coal is finely pulverized, and mixed uniformly with the correct amount of air. Fine pulverization cannot be stressed too strongly, especially with respect to the 50-mesh size. It pays to check each pulverizer regularly with fineness tests.

The proper distribution of coal and air at burners and in the furnace should be checked by weighed coal collections at burner, and by analyzing gases of combustion in the furnace from near the burners through the furnace and boiler. This requires suitable water-cooled gas-sampling tubes and gas-analyzing equipment for oxygen and CO in addition to the usual CO_2 determination.

(*Continued on page* 128)

Secondary-Network Systems

When greater reliability and flexibility are required in electric power - distribution systems to meet the needs of high-capacity production, the secondary - network system answers the problem at costs comparable to older less-reliable systems

By H D JAMES
Consulting Engineer
Westinghouse Electric & Mfg Co

▶ TO UTILIZE THE ADVANTAGES offered by improved industrial power-distribution equipment, several systems have been evolved to meet various conditions. Several of these systems were discussed in March POWER, pg 56 and 114. This article deals with secondary-network systems, first developed by utilities to increase distribution-system reliability and now modified for application in industrial plants.

Fig. 4 shows a secondary-network system in which power is supplied by two incoming lines controlled by circuit breakers *A* feeding four 3-phase transformers at load centers. Primaries connect to either one of two high-voltage primary feeders. Normally half of the transformer capacity connects to each feeder. If a fault occurs on one feeder, all the load can be carried on the other.

Network Protectors

On the secondary side, each transformer connects to duplicate conductors through a circuit breaker A_1 known as a *network protector*. This breaker can be operated manually to disconnect its transformer from the network. It may also be tripped by a relay on a power reversal caused by a fault in its transformer or on the primary feeder supplying the transformer. Such a fault would also automatically trip the circuit breaker at the supply end of the primary feeder, to disconnect it from the system. When this happens the network protectors on all transformers connected to this feeder open, leaving the entire load of the system to be supplied from half the network transformers until the transformers connected to the faulty feeder are switched to the good feeder.

During this temporary operation the transformers remaining in service may be loaded to nearly 200% of their normal rating. This eliminates the need for a large amount of spare transformer capacity. When normal voltage has been restored to the primaries of the disconnected transformer, their reverse-power relays automatically close the network protectors to connect them to the system again.

The secondary-loop-feeder system is protected by limiters. These are high-power interrupting fusible links, Fig. 2, that provide inverse time-delay short-circuit protection. They permit short-time overloads but protect against serious damage to conductors by severe overloads such as short circuits and dead grounds. In Fig. 4 the limiters are mounted in enclosed structures on both ends of the distribution center with the load circuit breakers. A typical load-distribution unit is shown within the dotted areas in Fig. 4, including limiters, load circuit breakers and load-break disconnecting switches for the limiters.

Secondary-Loop Connections

In Fig. 4 the secondary-loop connections are two parallel conductors per phase of equal size. If a fault occurs on one conductor, as at *B*, current will be fed into this fault and be cleared by the blowing of limiters B_1 to isolate the defective cable. A properly designed loop will not be overloaded when one of its parallel conductors is opened, because power is fed to the network from both directions. This permits replacing the faulty conductor without disturbing the power supply. If a load-bus fault

Fig. 1—Operator makes adjustments at the main incoming line control and metering switchboard for a 13,800-208-volt secondary-network system and a 2300-volt system serving a refrigeration load in a large manufacturing building

Serve High-Production Power Loads

occurs, such as at C, it is cleared by blowing all limiters C_1 connected to the bus. A fault in the load, or load circuit, such as at D, is cleared by the opening of circuit breaker D_1.

On the high-voltage lines, if a short circuit or ground occurs on the left-hand side of the primary loop it will open left-hand circuit breaker A, to remove the fault from the high-voltage system. Current from the secondary-network loop will tend the flow into the fault through the two network units connected to the faulty loop, which will be disconnected by opening of the network protectors A_1 in these units. This isolates the faulty primary loop, but leaves all the load being carried on the two network units connected to the live loop. The dead network units can now be switched to this loop when the load will be picked up automatically by them by the closing of their network protecting circuit breakers A_1.

When load on the network increases, it can be taken care of by adding another transformer at the location of the increased load. If load is shifted from one part of the factory to another, it can be readily compensated for by moving the transformer serving the load. Each transformer, under normal operating conditions, furnishes power to the equipment in its immediate vicinity. It only depends upon other transformers when it is out of service or to handle short-time local demand loads averaged out over the entire system.

The network loop should have a total carrying capacity equal to the rated capacity of one transformer and all transformers should be readily interchangeable. Ordinarily the network loop does not carry full transformer load, because part of the load normally supplied by a transformer is tapped off the load bus to which the transformer is connected, and only about half the load between two transformers is supplied from either end of the corresponding section of the loop. If the system is properly designed the maximum current in any section of the loop when all transformers are in operation will seldom exceed half the capacity of one transformer. This reduces the voltage drop in the loop and maintains normal load voltage. Should a transformer be disconnected from the circuit for any reason, the network conductors near adjacent transformers may carry full-load current of one unit.

Each network transformer should have capacity about equal to the maximum load on any section of the loop between transformers. It is preferable to have the transformers a little larger than this, as the load on the distribution center may be increased later. Transformers should not be much larger than determined by the foregoing requirements as any increase in their size increases the size of the secondary network

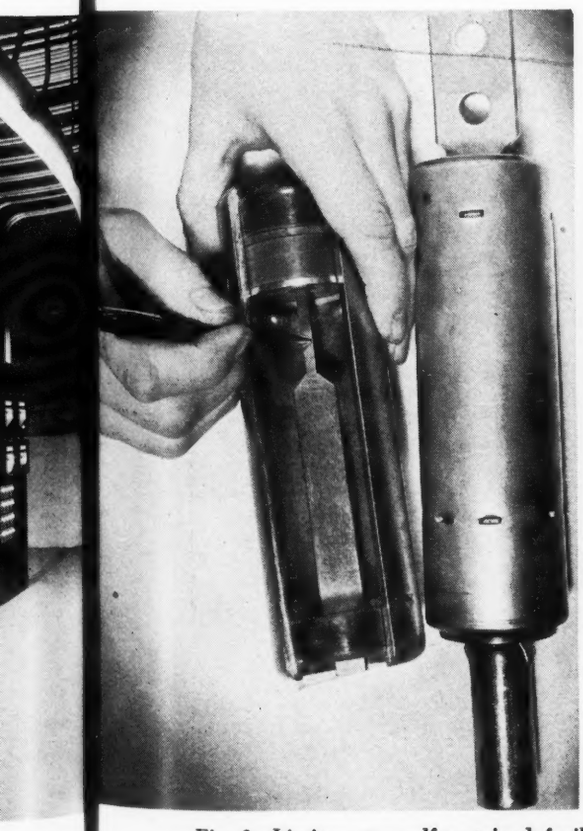


Fig. 2—Limiters are self-contained fusible links that serve as inverse time-delay short-circuit protection for parts of the secondary-network system. Fig. 3—Typical vault for six 3-phase 750-kva and three 3-phase 1000-kva network transformers and protectors serving a large building. The 750-kva transformers connect to a 208-volt and the 1000-kva to a 2300-volt network

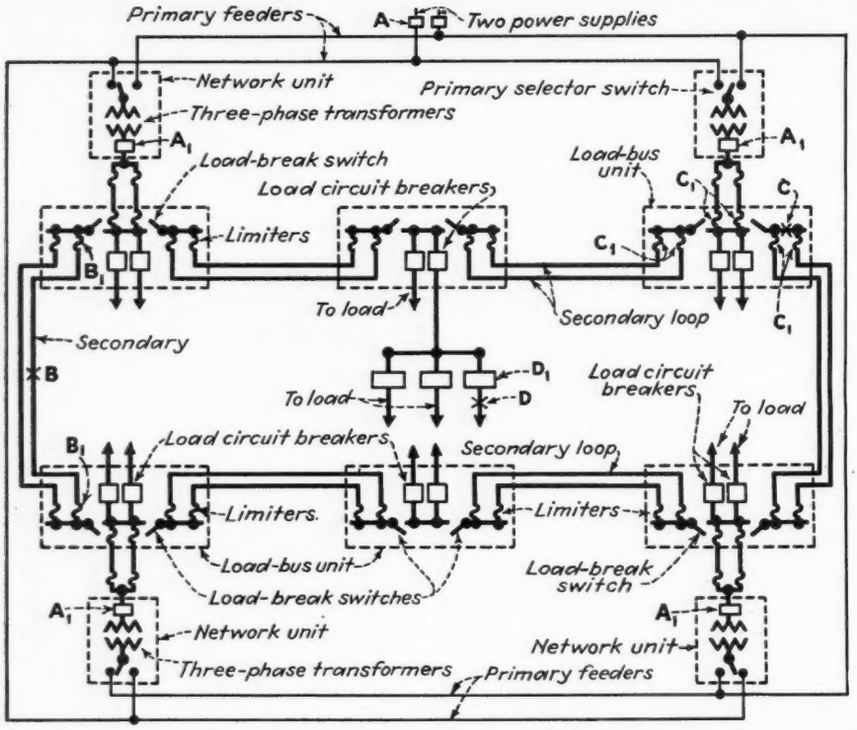


Fig. 4—Secondary-network system supplying power from four transformer stations

loads for the entire installation, to obtain the approximate total kva capacity required. Then distribute the load on the floor plans of each building, and select the approximate location of each power and lighting distribution center. This layout will indicate the probable location of maximum load from these distribution centers.

This maximum load, with a safety factor added, will determine the size of the branch circuit feeding the distribution cabinets from one of the centers and will fix the minimum transformer size which should be used. From the transformer size and the total power required, the number of transformers can be estimated. If the number seems excessive, the next larger transformer can be selected. This, of course, increases the size of the secondary-network loop conductors and should be very carefully considered before such a decision is made. It is desirable to have the transformer within 150 ft of its load;

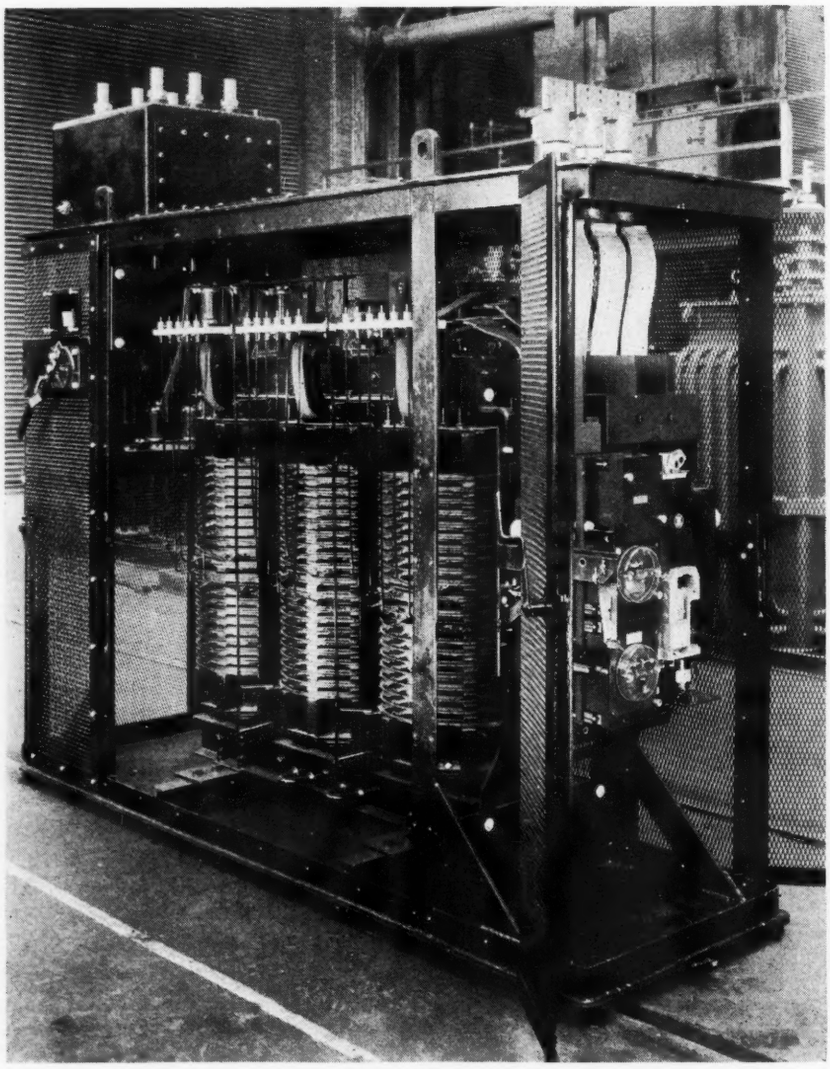
loop and adds to the system cost. Increasing the number of transformers on a network system with the same total kva capacity boosts transformer costs. By keeping transformers small, network conductor size can be reduced. In most cases, feeder cost will be an important part of the total.

Locate transformers where they are accessible and as close to the secondary network as possible. Ordinarily this consists of an overhead loop through each factory building at least 10 ft above the floor, or a little higher for clearances and to protect workers. A good location for transformers is on platforms above the floor near the level of the network conductors. If no danger of flooding exists, the transformers may be located in manholes under the floor. They can also be installed on the roof, but there they are not easily accessible and must be protected from weather. Transformers on the working floor are sometimes objectionable because they take valuable floor space.

Air-cooled, self-cooled transformers which are fire and explosion proof, are most suitable for industrial application with the network protector and relays assembled in one end of the ventilated transformer housing and the high-voltage transfer switch in the other end. This makes a compact unit that can be wired and tested in the factory. This assembly is called a "network unit."

When designing a network system determine first the power and lighting

Fig. 5—Typical network unit with double-throw primary switch on the left, a 3-phase air-cooled transformer in the center and a network protector on the right



therefore, locating the load centers on the floor plans and determining their distances from the transformers will give another check on the number of transformers wanted.

Primary Voltage

When central-station power is available, it may be desirable to use the incoming-line voltage as the primary of the network system. This should not exceed 15 kv. Feeders for 15 kv should be run underground with their ducts in concrete where they run from the manhole up to the transformer. This is also desirable for 6600-volt feeders. Small plants can economically use 2400-volt primary power, run overhead in standard conduit.

Install an automatic regulator to maintain the voltage within close limits at the lamps. When central-station power is delivered at a voltage higher than required, it can be reduced by a combination transformer and step-type regulator which will cost less than separate transformers and regulators. The transformers should have taps, so that they can be adjusted to deliver the required voltage at the lamps at half load on the plant, with the voltage regulator in approximately its central position. Ordinarily transformers can be obtained with four 2.5% taps on the primary.

Frequently, the best secondary network voltage is 120 for lights and 208 for motors, supplied from a 4-wire 3-phase system. This requires larger motor feeders and circuit breakers than 440-volt motor circuits, but the higher voltage means a separate distribution system for lights. This extra cost may be greater than the saving in motor feeders. It is frequently desirable to provide connections for lights on production machines. When 120- and 208-volt power is used a small neutral wire can be run to each machine to provide lights and control circuits. Where 440-volt motors are used, a separate lighting circuit must be run to the machines.

When the power lines run underground, manholes should be located not over 400 ft apart, as this is about as far as cable can be pulled successfully through conduit. Underground ducts should be of fiber encased in concrete. Make manholes of ample size for pulling in the cables and making splices. After the splices are made, train the cables around the manholes and support them on cable racks. Fireproof all cables in manholes to prevent damage to the lead sheath of adjacent cables should fault occur on any of them.

Fig. 6—Engineer making the final check on a network protector that trips faulty equipment off the system and connects it back again when fault is cleared

Direct-Current Power

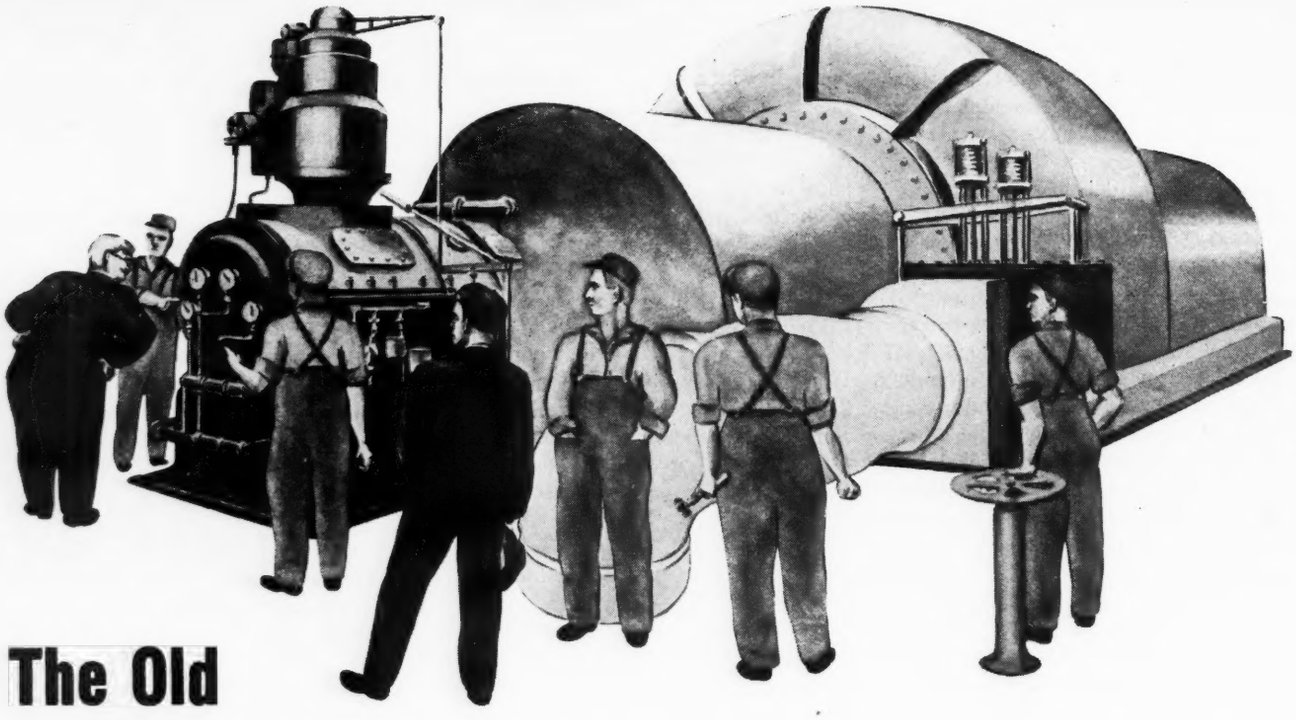
In many places dc power is required. This can be obtained from motor-generator sets serving a distribution system which is connected to radial feeders in the buildings. When the motor-generator set is large, it is desirable to use separate transformers for supplying power at 2400 volts. Use synchronous motors on these sets to improve power factor. Where air-compressor motors are large, they should also be supplied from the 2400-volt circuits and driven by synchronous motors.

Where emergency power is required in the event of the failure of central-station service, diesel units can be installed in the power station and arrangements made to connect them to the yard lights, night lights in the buildings, and other essential services. The storage battery usually provided with the switchboard for operating the circuit breakers can furnish emergency power to a few lights in the power station to enable the plant operator to see while he starts the diesel-electric unit.

Network Applications

Secondary network systems are economically limited to medium and large-size plants. Where two or more primary feeders are available for power supply, the total peak load 1000 kva or more, and the load density 10 volt-amperes or more per square foot of floor space, installation of this system should be seriously considered. It should also be considered for smaller plants where continuity of service is of prime importance.

Outstanding advantages of the network system are increased reliability and flexibility. The latter permits adapting the system to growing or changing load conditions with a minimum interference to normal system operation. It also provides uniform and minimum voltage regulation and permits across-the-line starting of relatively large motors, resulting in a considerable saving in cost and simplification of starting equipment.



The Old Chief

18– Visitations

Another in the series by William Doran, chief engineer, Essex County Sanatorium, Windsor, Ontario. Writing of the inspiration of the past, he has captured much of the human side of engineering that lies beneath the maze of power plant costs and the wavy lines on paper disks

▶ AFTER THE OLD CHIEF had turned sixty it was very hard to pry him away from his easy chair in the evenings. However, I recall one eventful week when we managed to have him out sightseeing almost every night. The occasion was a "Know Your Home Town" campaign that one of the service clubs was staging. The downtown stores featured big displays of town-made goods and one or another of the manufacturing plants would hold open house every night. Visitors would be taken from the raw-material department to the shipping room and would, in time, become suitably impressed with the importance of our town and its industries.

I missed the first three nights of the visitations for the reason that I was trying, against the day of our own reception, to make our plant look a little less like a junk yard. But I attended on most of the other nights in the company of the Old Chief and admit that I would have increased my knowledge of home-town products considerably if I had gone alone.

The Old Chief, being an incorrigible humanist, was much more interested in renewing old acquaintances and making new ones than he was in being impressed. For instance, at the shoe factory he ducked out of a lecture on the "Cutting and Processing of Leather" in order to talk about his imported roses with the old night watchman. It was much the same story at the mill, where he found a kindred soul in the engineer on duty, who happened to be an old "deep sea" man. He tried to hustle me off with the other sightseers, but I was much too interested in stories of ships and their engines and the ways of men at sea to miss a word of it. On Friday night we drove out of town to visit the utility plant, the largest in the district.

Meet Mr. Atkins

The Old Chief was duly impressed with all he saw. He was careful to note the furnace temperatures and the temperature of the gas leaving the economizers. The turbine speed control engrossed him for an hour and he marveled at the almost perfect condensing system. One of the first operators we spoke to was a Mr Atkins; on our way through the plant I was amused by the fact that he addressed several of them as Mr Atkins. The fact that they were all wearing olive-green overalls evidently misled him. Going home I tried to draw him into a discussion on turbine bleeding without much success. Evidently his mind was still on the men he had been talking to, because suddenly he asked me if I had ever seen the Chinese Labour Corps in France during the last war.

"You know," he continued, "trainload after trainload of those men crossed Canada from Vancouver to tidewater on their way from China, and in order that the emigration laws might be overcome, they were shipped "in bond" with one Northwest Mounted Policeman in charge of every 100 laborers.

On one of these trips the train stopped at Sudbury for about an hour, and ten minutes before train time one of the constables discovered that he was two passengers short. He immediately legged it for the town and at the first Chinese laundry he came to grabbed himself two Chinamen. In due course he delivered his appointed quota at the end of the journey."

I do not know if there was anything apropos in the Old Chief's telling me that story on the night of our visit to the big plant, except that he may have been affected by his failure to distinguish one man from another in the twenty or thirty he had just been talking to.

He stoutly denied there was any inference, but I believe that he was thinking back to the days when no two men in the plant dressed or talked alike or had even remotely similar educational backgrounds. Perhaps he was thinking of the days when, if a man was a "sport" he dressed and talked "sporty." If he was religious, you knew it by his sober mien, and if he was a drinking man, he looked the part.

Build Bombers in World's Largest Air-Conditioned Structures

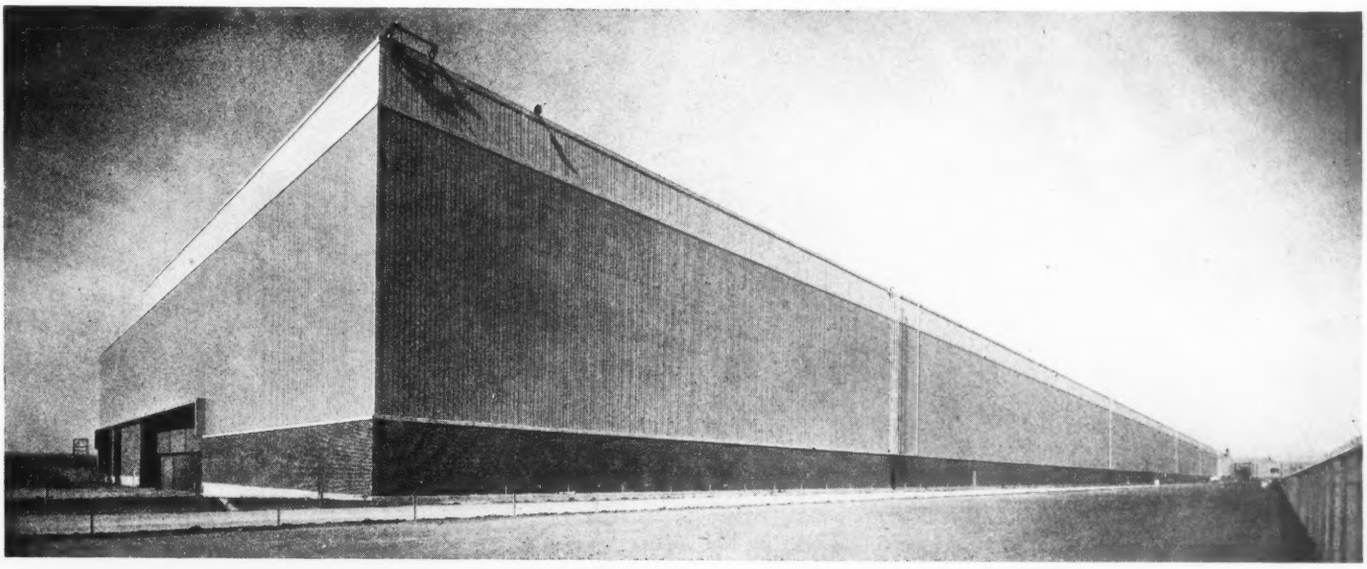
▶ **Designed by Austin Co engineers to provide maximum safety, automatic blackout protection, economical air conditioning and best obtainable working conditions, this bomber assembly plant and an identical structure several hundred miles away rank as the two largest air-conditioned buildings in the world.**

Faced with the need for uninterrupted production of heavy bombers at the fastest possible rate, the Army Corps of Engineers and the Air Corps set standards to insure working comfort and high production efficiency right through the sultriest summer heat. The "ferroglas" construction introduced by Austin engineers to meet these requirements combines glass fiber, sheet steel, special vaporproof paper and asbestos coatings in what are probably the most heavily insulated sidewalls and roofs ever designed for a factory. It also gives exceptional sound control; at least 75% of all factory noises will be absorbed in walls and ceilings.

A utility system supplies 60-kv energy to three large 60,000/4160-volt transformers in an outdoor substation on the property. An underground 4160-volt distribution system terminates at individual switchboards and transformer stations. In the assembly building there are ten individual unit substations consisting of a 4160/440-v transformer with individual switchboard to control power and lighting feeders for each 400-ft section of the building. An underfloor 440-volt duct system supplies power for operating small tools within any radius of the equipment. A steam-turbine-generator serves as standby if main power supply fails; this service will also operate floodlights and obstacle lights.

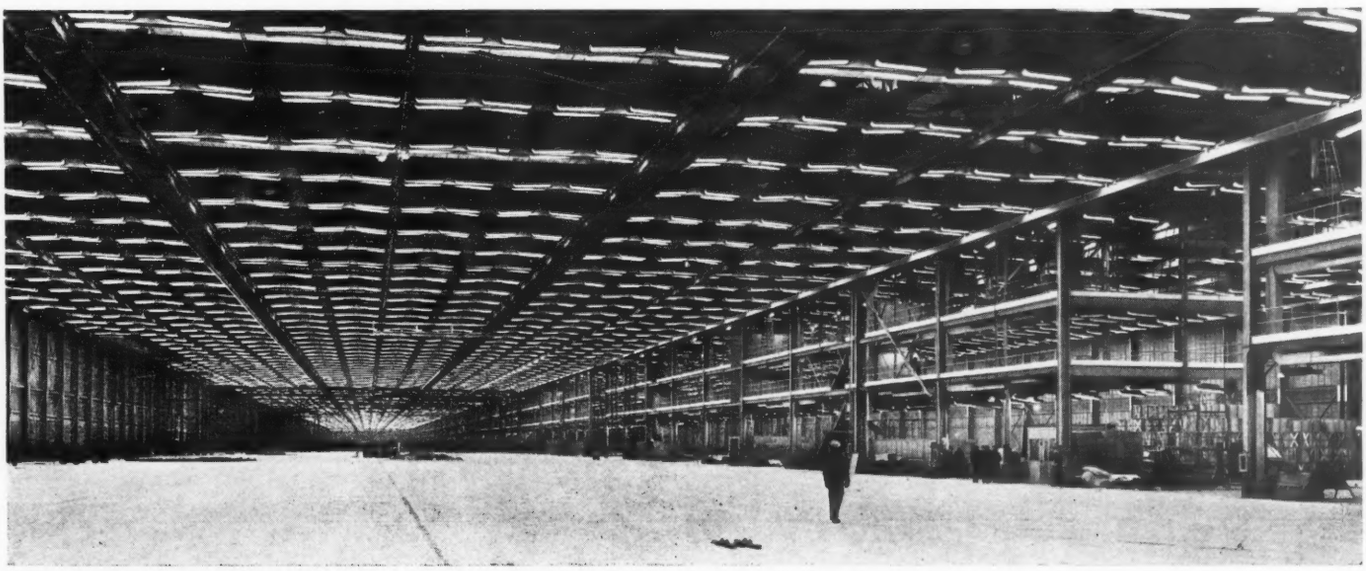
In the central heating and air-conditioning plant, three 225-psi gas-fired steam generators, with an emer-

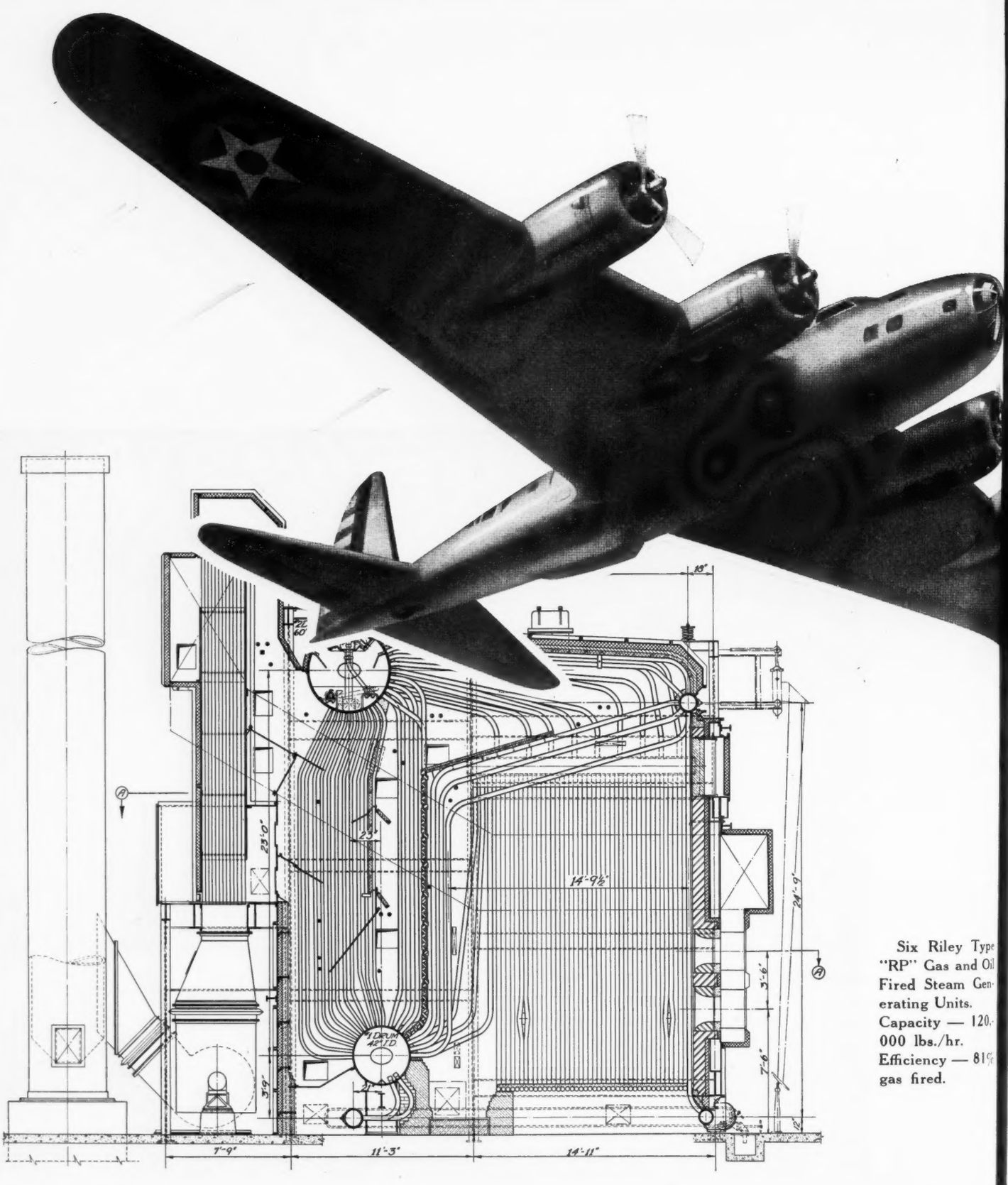
(*Continued on page* 90)



Started April 18, 1941, the plant is more than 6 stories tall and would extend nearly a dozen blocks in the average city

The main assembly aisle has a 40-ft clearance. White fiberglas lining the sidewalls and ceilings and a white cement floor insure maximum light reflection throughout the working area, equipped with rectified fluorescent lighting





Six Riley Type "RP" Gas and Oil Fired Steam Generating Units. Capacity — 120,000 lbs./hr. Efficiency — 81% gas fired.

RILEY

STOKER CORPORATION, WORCESTER, MASS.

Boston New York Philadelphia Pittsburgh Baltimore Buffalo Cleveland Detroit Chicago St. Louis Cincinnati
St. Paul Kansas City Denver Seattle Portland Los Angeles Houston New Orleans Atlanta Memphis Richmond

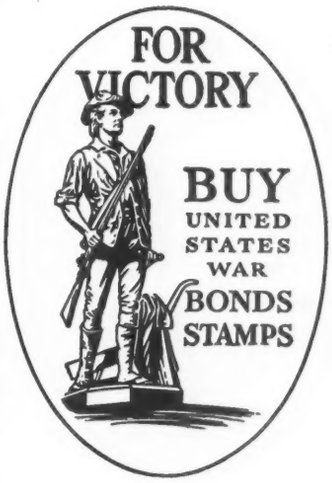
It will pay you to visit modern Riley Installation

Two of the world's largest bomber plants have recently been completed in Texas and Oklahoma ★ ★ Six Riley Steam Generating Units supply steam for these plants

TWO NEW BOMBER ASSEMBLY PLANTS have been recently completed in Texas and Oklahoma. They are two of the largest bomber plants in the world . . . housing two of the largest unobstructed floor areas ever built. Each plant is almost a mile long, having a main aisle with a 200 foot clear span and a 120 foot clear span side aisle.

Construction started last April 21st in Texas . . . was pushed day and night . . . 7 days a week. 27,000 tons of structural steel were erected in 80 working days . . . the entire project has been completed on schedule. These are "Controlled Conditions" plants which automatically become blackout plants . . . light is controlled; atmospheric conditions are controlled; noise is controlled.

Three 100,000 pounds per hour Riley Steam Generating Units were selected for each of these plants. In spite of the fact that contracts for the boiler equipment were awarded as late as July 15, 1941, Riley was able to completely install this equipment ahead of the general construction schedule.



A survey of your power plant by a consulting engineer will possibly show ways of making surprisingly large savings in power costs

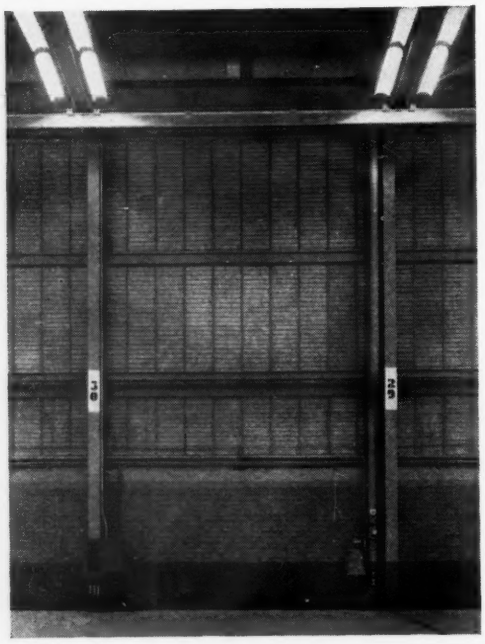
COMPLETE STEAM GENERATING UNITS

BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • AIR HEATERS
ECONOMIZERS • WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • FLUE GAS SCRUBBERS

before purchasing Boiler or Fuel Burning Equipment

Build Bombers in World's Largest Air-Conditioned Structures

(*Continued from page* 87)

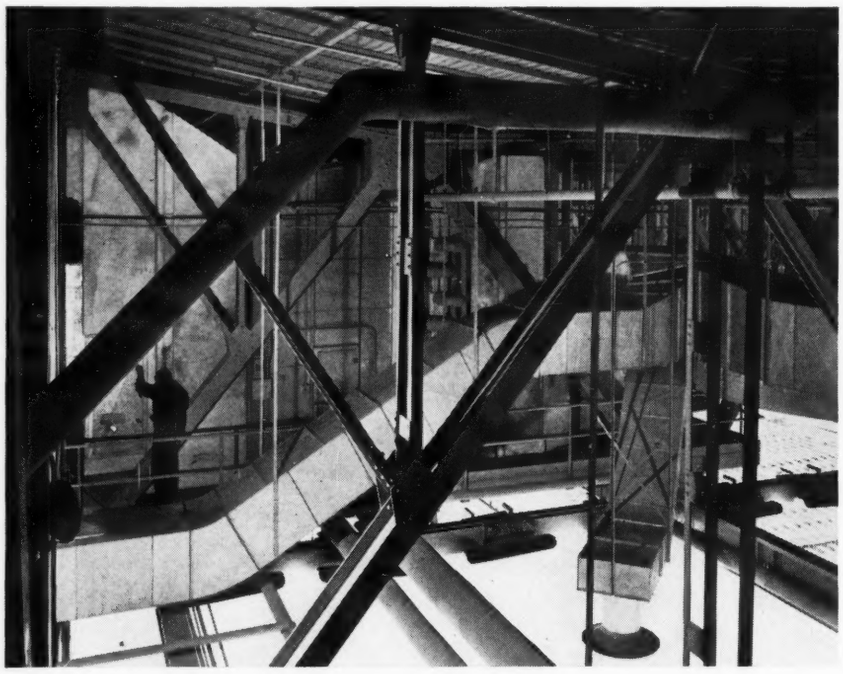


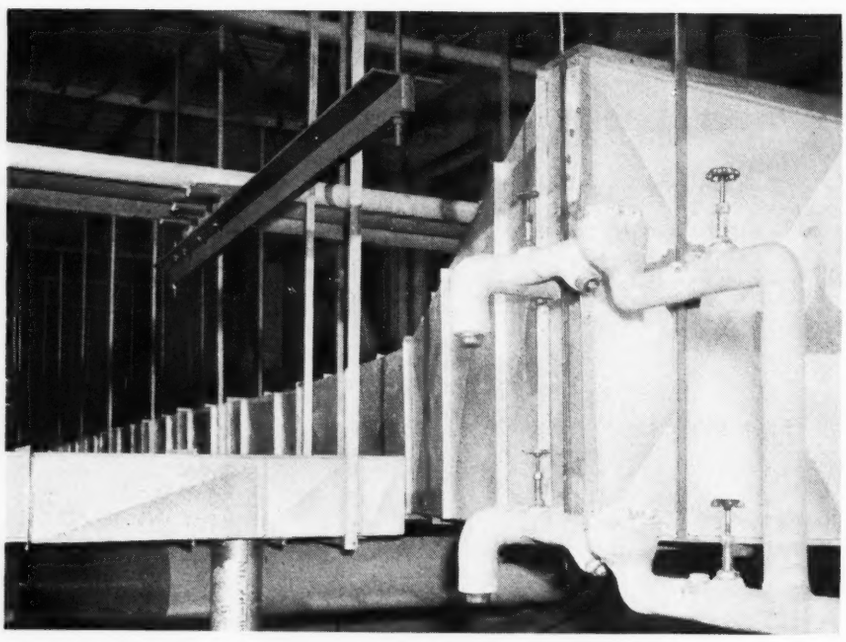
A reinforced masonry wall with fiberglas insulation, conforming to accepted standards for bomb resistance, and capped with a precast concrete sill, rises around the building's base. Painting the acoustic cinder block on the inside in two shades of green, the darker band forming a dado, makes for easy maintenance. The sidewall above the masonry is formed by "C" channels 3 ft wide and 12 ft high, extending from girt to girt. The horizontal lines are formed by expanded metal lath slipped under the flanges of the "C" channels to hold the white fiberglas used for acoustic control, light reflection, and insulation. This typical bay shows how power-distribution facilities, transformers, sprinkler pipe and automatic temperature controls are located at columns. The conduit leading from the open switch box to the floor controls power distribution through the underfloor duct system, which reaches outlet points throughout the entire area. The enclosed switch box at the right directly in front of the small transformer affords manual control of lighting in the immediate area.

Special booster coils in air-conditioning ducts above door openings and sections reaching the building's outer extremities facilitate temperature control. The insulated pipe entering the duct at this point carries hot water for heating the plant in winter and cold water for summer cooling.

gency fuel-oil system, supply steam for the heating system and to operate the steam-turbine-driven refrigerating compressors. Six large and one small compressors supply chilled water to 20 air-conditioning units located in the roof trusses. Each unit consists of two fans, filters, coils, main ducts, and outlets. On the heating cycle, boiler steam passing through heat exchangers provides hot water to be circulated to the various buildings through the same piping used for chilled water on the cooling cycle. Three 1500-cfm motor-driven compressors furnish air to the various buildings.

This typical air-conditioning platform high above the working area occupies more space than a 6-room house and is supported by trusses that span the plant's 200-ft assembly bay. Ducts reaching out in four directions from each unit serve a floor area of many thousands of square feet.





WARTIME POWER CLINIC

Practical ways to create emergency capacity. Cures for overloads, breakdowns, short-handed staffs, lack of spare parts, etc. Contributions invited at regular rates

Your Bearings "Keep 'Em Rolling"

By PHIL SWAIN

Bearings alone can't win a war, but they can lose one if they fail. If the wheels of industry stop turning we're licked. When the Japs took charge of the Malay Peninsula and the East Indies they shut off our tin almost as completely as they did our rubber. True we still get appreciable quantities of tin from Bolivia and other Latin American countries, but it doesn't begin to meet the demand. Hence we're going to be rationed on tin cans, also on tin for bearing metals, both babbitts and bronzes.

Our SOS for information on emergency bearings has brought in some good practical comments here reproduced, and we expect to run more of these next month.

If this subject touches your interests (and it probably does) you'd better turn also to the symposium of bearing specialists on page 74.

Let's combine the specialized knowledge of the bearing experts with the sound mechanical sense of the practical plant operating men to "keep 'em rolling."

What About Bearings, Relays, Men?

"CAN YOU SOLVE THESE PROBLEMS?" on page 95 of the February Wartime Power Clinic recounted troubles of the engineer and electrician in a Connecticut war production plant working nonferrous metals. Here are the troubles in brief:

Bearings: A ball bearing wore out and couldn't be replaced. A substitute cast-iron bearing lasted one week, a bronze one two weeks. What to do? Even bronze bearings were hard to get. Would it pay to build a furnace to remelt scrap brass for bearing castings?

Relays: An electric metal-melting furnace or "pot" was shut down by failure of the pyrometer-operated control relay. Operator didn't know where to get another.

Men: Skilled maintenance men were leaving for the armed forces, said the engineer. How to replace them?

Here are some comments from POWER readers—EDITOR

Bearings and Relays

NO DETAILS ARE GIVEN regarding the size, load, or speed of the cast-iron bearings under discussion, but there may be several reasons for the failure:

(1) If the shaft is not hardened, it was probably roughened by the cast-iron sleeve.

(2) Dirt or other abrasive material may be getting into the bearing, causing excessive wear.

(3) Bearing dimensions may be wrong. If the diameter is too tight, bearing will seize. If too loose, the actual area supporting shaft will be small, and wedging action will break down the oil film. The same will be true if the bearing is too short.

(4) Perhaps the lubricant used doesn't form an oil film of sufficient strength.

Most oil companies maintain a free consulting service on proper lubrication. They will also recommend the proper clearances to be used with their product and will calculate the proper size of the bearing that should be used for existing loads and speeds.

For several months our shop has had an arrangement with a small foundry that casts our scrap brass and bronze into the shapes we need. We never use lathe cuttings for bearing material because steel chips find their way into this material. If the requirements are small, some of the fellows who follow casting as a hobby will be glad of an opportunity to show you what they can do. For small jobs you can get better results in this manner because they use the material you provide.

Now let's discuss the matter of replacing the temperature-control-relay on the electric melting pot. For a small furnace of this sort an old control relay from an oil circuit breaker might be used. These relays usually operate from batteries, so the coil might need rewinding. Also it would be necessary to place a copper shading coil around a part of the magnet iron to reduce chatter and the effect of permanent magnetism that would result.

Consult your power company about this. They may have just what you want, and most of them are willing to go more than half way toward helping a customer.

Finally, don't you think that the fellows who are going to be out of jobs as automobile mechanics as our tires wear out could be easily trained for plant maintenance work?

Boise, Idaho FRED MCCORMICK

Made His Own Castings

WE HAD A LOT OF JUNK BRONZE so bought a graphite crucible to melt it in. Instead of building a special furnace we used one of our 5000-sq ft boilers. At high loads the temperature at the side inspection door is high enough to melt the metal.

We cast the slugs in split pieces of pipe, allowed them to cool slowly, then knocked them out with a sledge and punch. We have found this metal satisfactory for bearings.

We were also running low on aluminum collector-shoe liners for our trolley-wire pickup on the monorail coal crane. We had saved the worn shoes so we made a form out of strap iron, melted the old shoes and cast the new. The homemade shoes look as good as the bought ones and, as

they were made a little thicker, last longer.

Mitchell, S. D. K M WHITE

Oil Groove Location

IT IS MY EXPERIENCE that if you melt your own brass for bushings you will find that old metal is casty and will have large pits.

If a bearing bushing is horizontal and properly lubricated, with a smooth shaft, it should last for many weeks. The lubrication grooves should be placed on top quarters so that the oil will be picked up by the shaft and will form an oil wedge around the shaft that will almost eliminate bearing wear. Vertical bearings with long grooves down through the bushing walls are of no value at all. The oil runs out and the bearings wear quickly.

Huntington, W. Va. L C BRYANT

Cast-Iron Bearings

THE CAST-IRON BEARING should have worn longer than just a week; cast iron will wear to a glassy surface in a short time and then run with little friction. But the bearing must be copiously lubricated to prevent overheating, or total destruction will occur.

Flood-lubricated cast-iron bearings should prove satisfactory if bearing pressure and speed are not excessive. I would suggest keeping within 400 psi of projected area (See Fig. 1).

The longer and more frequent the starting periods the greater the wear, particularly if starting under load. Wear can be reduced if the machine is always started without load.

Another trouble may be that the bearing is not radiating heat fast enough, so that it runs too hot. Operating temperature should not exceed 180 F. If the bearing should run too hot, artificial cooling (for example by a stream of air across the bearing) is possible. Fig. 2 shows a home-made cooling fan.

Proper alignment is important; an out-of-line bearing will fail from overheating and excessive wear caused by metal-to-metal contact. This can be cured either by proper alignment or by self-aligning bearings.

If the original bearings were bolted to independent pedestals, they can be made self-aligning in one plane by bolting to a pivoted plate, Figs. 3, 4, 5.

Philadelphia, Pa. SAMUEL MARANO

Tips on Relining Bearings

(While the following relates to standard, rather than emergency procedure, it seems worth including in a general bearing discussion—EDITOR)

BEFORE ATTEMPTING TO RELINE A BEARING remove all traces of rust, dirt, scale and old lining. Clean out sand by wire brush or blast, by muriatic acid or hot soda ash. For best results in anchoring the new liner, hand-clean the anchor holes or grooves in the shell. Lining from bronze shells may be removed by heating to a temperature not exceeding 440 F.

Tinning a liner binds it to its backing and thereby makes peening unnecessary. Solid support prevents cracking as bearing wears. The tinning alloy is a 50-50 solder applied at some temperature between 770 and 825 F.

In emergencies it may be necessary to cast babbitt directly around the shaft, but where possible use a mandrel slightly smaller than the shaft. This

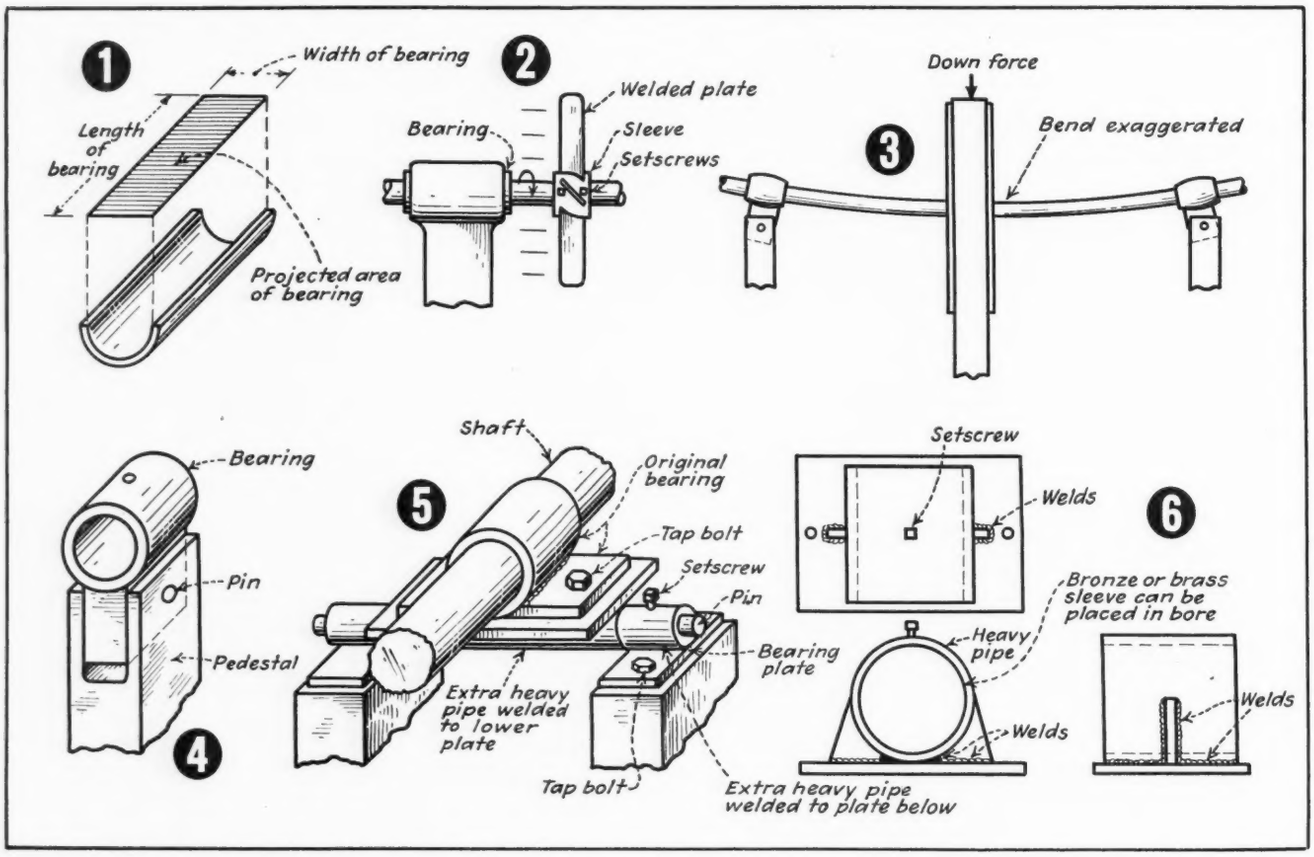
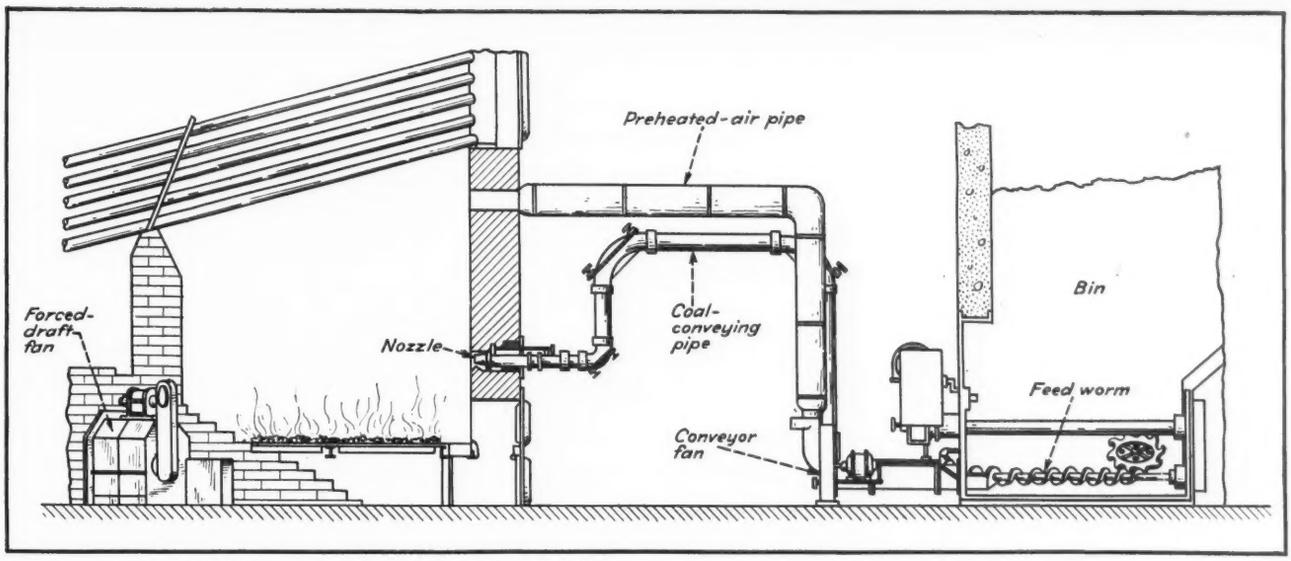


Fig. 1. Divide the total load on the bearing by the projected area in square inches to get the "loading" in pounds per square inch (psi). Cast iron will easily carry 400 psi if well lubricated and operated at moderate speeds. Fig. 2. If bearing runs warm it can be cooled by home-made fan mounted on shaft. Fig. 3. For bend from variable vertical loading single pivots in bearing supports will maintain alignment (Bend exaggerated for clearness). Fig. 4. Home-made pivoted bearing. Fig. 5. Existing bearing can be bolted to pivoted plate like this. Fig. 6. Simple bearing made from heavy pipe



Typical pneumatic-spreader-stoker installation with bin-to-furnace conveying arrangement.

permits preheating the mandrel for better flow and more gradual cooling of the metal—and also gives a bearing that has metal to be scraped to fit.

If the top shell has a grease-cup opening, the relining metal may be poured in through this hole, which may later be drilled clear. For longer bearing life, proper oil grooves should be cut to distribute the oil to all parts of the bearing. Provide two holes in the cap for bearings longer than 6 in.

Cut circular grooves ¼ in. or ½ in. from end of box, according to the bearing size. For best results, grooves should be from $\frac{3}{32}$ to $\frac{5}{16}$ in. deep.

Out-of-line bearings will wear out quickly. To avoid fast wear from dust, use metal collars to hold felt washers on the shaft against the bearings.

For longer life, be careful of methods and materials. If new babbitt is unobtainable, search the plant for babbitt in discarded bearings before resorting to makeshifts. Many engineers will be surprised to see how much valuable material gets hidden in out-of-the-way places. Don't neglect this source.

Fairview, N. J. MARTIN N GOZDENOVICH

Step Up Stokers To Meet War Loads

The following comments amplify the suggestions put forward in the March special section on stokers—EDITOR

AS THE NATION'S COAL CONSUMPTION increases from 500 million tons in 1941 to an anticipated 560 million in 1942, close selection of coals may not be possible and means will have to be found to burn coals tributary to a given market.

There are thousands of small plants still hand fired. For these, the solution lies in installing stokers to conserve fuel, increase steam output and release man hours for more important service. In many plants stoker equipment is obsolete to the extent that entire replacement is indicated because of high maintenance, insufficient steam output or inability to burn the full range of available coals.

Spreader stokers are meeting these conditions admirably because they can handle a variety of coals, including low-ash-fusion types and fine sizes such as ½-in. to 0, and smaller. Pneumatic spreader units, with conveying arrangements, offer the further advantage of eliminating part of the coal-handling problem.

Cleveland, Ohio T A MARSH
Iron Fireman Mfg Co

THE ARTICLE "STEP UP STOKERS FOR WAR LOADS" covers the situation thoroughly, but more emphasis could have been laid on coal selection. Many coal-burning plants are limited in capacity because selection is based entirely on cost per M lb of steam. In many cases, purchasing coals with much lower ash content and higher ash-fusion temperature, from different seams or territories, will permit increasing burning rates and furnace heat release without stoker changes. This would entail a slight increase in cost per M lb of steam but in some cases it would be no more expensive than a major or even minor improvement in the construction of the stoker or furnace.

Furthermore, we believe that greater stress should have been placed on the use of effective control systems. It has been our experience that high loads may be carried more efficiently and furnace conditions improved if proper automatic combustion controls, plus accurate indicating and recording meters, are installed.

Minneapolis, Minn. C W BROS
Vice-President,
Wm Bros Boiler & Mfg Co

Dissolved Insulation

ABOUT A YEAR AGO we were faced with removing two No. 14 wires that had shorted and welded themselves inside a 50-ft length of half-inch conduit. Starting from a switch box in the pump room, this conduit twisted and turned through the ceiling and walk, went through 15 ft of red granite and terminated in a concrete block to supply a lamp post on the corner of the steps at the entrance to the building. All attempts to remove these wires with a fish tape failed; they were stuck so tightly the hooked ends would snap off the tape every time we tried to pull them through.

Ordinarily we would abandon such a conduit and install a new line, but in this case we couldn't, because it would mar the building.

We are presenting our solution with the hope that it will save someone a lot of grief in a similar situation—and also help save conduit in these days of scarcities. Steel tubing of all kinds is strategic material.

We first thought that if we could find where the conduit entered the pump room we could cut a hole in the ceiling, cut the old conduit in two at that point and install new conduit from there to the switch panel. So we hooked up a dc generator to the two ends of the conduit and passed 15 amp through it.

We had hoped this would produce a magnetic field strong enough to swing a compass. However, there were many pipes in the room and the compass impartially pointed to everything.

Next we tried connecting a 140-amp ac welding transformer to the conduit and one end of the wires—reasoning that the short was of much higher resistance than the conductors so that the heat generated at the junction might burn the short loose.

This was too successful. While the short burned away, the wire also heated excessively throughout. This burned and swelled the insulation loose and jammed the wire in the bends. We had never stopped to figure whether there was enough oxygen in the conduit to support combustion. If we had we could have admitted a stream of air from a portable tank and burned enough of the insulation away to free the stuck wires.

We solved this new problem by capping the low end of the conduit, pouring in a quart of carbon disulphide, then capping the high end and letting it soak. Carbon disulphide is a relatively inexpensive, highly volatile liquid that smells like concentrated essence of polecat, but it has a tendency to dissolve rubber and tar. It is *highly inflammable*, so be extremely careful of open flames if you ever try this.

About three days later we uncapped the conduit, pushed in a fish tape and pulled out the wires with the greatest of ease. We then took a small tank, charged it with compressed air to a hundred pounds, connected it to the conduit and blew out the gummy residue left by the carbon disulphide.

We repeated this several times to insure evaporating all the solvent that might remain in dips or pockets in the conduit.

After this it was easy to install new wiring.

St. Louis, Mo. ALBERT A SCHULKE
Washington University Power Plant

Wanted—Melting Furnace Design

WILL YOU PLEASE INSERT in POWER a note asking for drawings and full details of size and kind of wire and insulation of an electric furnace to melt brass, bronze, etc., to a temperature of 2000 F, say, and to hold about 500 cu in. of molten metal in the pot? I have a number of bronze and brass bushings I wish to melt.

Saskatchewan, Canada

Note: Please confine designs to those known to be practicable. Give complete details and dimensions. Information on gas-fired melting furnaces will be equally acceptable. Be sure to give all necessary information regarding burner, blast, etc.—EDITOR.

How to "Roll Your Own"

"NEVER MAKE YOUR OWN roller bearing if you can buy one" is good advice. But the war puts men on the spot. When bearings fail on essential machines and new ones can't be bought in a hurry, the old maxims no longer apply and the resourceful engineer finds a way even if he has to roll his own.

This issue's Clinic has a lot to say about journal bearings. Next month we shall publish some pointers on home-made roller bearings, including a table of race dimensions. Just to see if one of the suggestions was practical the editor made up these sample rollers from ¼-in. drill rod.

Go "Treasure Hunting"

I HAVE NOTED WITH INTEREST your comments (POWER, February, 1942, page 95) on the supply difficulties experienced by a metal-working plant in Connecticut. In these days of pinches and priorities my advice to the engineer of that plant would be to organize a treasure hunt through the second-hand shops in the nearest large town or city. He will be surprised to discover how many invaluable parts and gadgets can still be picked up in these subterranean and back-alley junk shops. He probably won't find anything that fits his exact specifications, but there will be something similar that he can adapt to his purpose with some minor alterations.

Incidentally, Mr Editor, you are handing out dangerous advice in suggesting that the engineer might remelt brass junk and then cast his own brass bushings. Would you like to have your editorial and/or physical head chopped off by Mr Nelson? The private melting of copper and brass scrap (except by railroads and utilities) is very much forbidden under order No. M-9-B, unless specifically authorized and Uncle Sam isn't very liberal with special permits nowadays.

Old Bridge, N. J. A J LUBELEY

THE OPERATING ENGINEER

George Edwards
Advisory Editor

PRACTICAL AIDS • MAINTENANCE HINTS • QUESTIONS—ANSWERS

PUBLISHED MONTHLY AS AN INTEGRAL PART OF POWER

Small-Plant Performance Can Be Bettered, Even in Wartime

With today's conditions making major alterations expensive and nearly all equipment hard to get, ingenuity and "know how" are needed to turn the trick. J S Kernachan, Assoc Eng, U S Eng Dept, tells how efficiency and output of the U S dredge Savannah were boosted —a practical blueprint for similar easily made improvements in small plants ashore

► SMALL-PLANT performance *can* be bettered even though today's conditions make major alterations expensive and nearly all equipment hard to get. Combining ingenuity and "know how" with a small investment and a little new equipment will turn the trick, as the following description of improvements to the U S dredge Savannah shows.

As used in U S Engineer Dept operations, a hopper dredge consists of a self-propelled vessel equipped with centrifugal dredge pumps, movable suction and fixed discharge pipes, and "hoppers" for storing the material dredged. The power plant, in addition to propelling the vessel, provides for mechanical raising and lowering of suction pipes and opening and closing of hopper gates and furnishes light, heat, water, refrigeration and ventilation for quarters occupied by officers and crew.

In operation, the vessel proceeds to the channel to be dredged under full power of the propelling engines. At the dredging site, speed is reduced to 2-4 mph, trailing suction pipes are lowered and pumping continues as the vessel travels back and forth over the dredging cut. Heavier materials settle to the bottom of the hoppers and water escapes through the overflows until the hoppers are loaded. The dredge then stops her pumps and proceeds under full power to a suitable deep-water disposal point where hydraulic cylinders open the hopper gates to discharge dredged material. After the hoppers are emptied, the gates close and the vessel returns to the dredging ground to repeat the cycle.

Built by Maryland Steel Co in 1904, the dredge Savannah is 177 ft long with a molded breadth of 38 ft and a molded depth of 19 ft amidships; hull and superstructure are steel. Two 14×28×24-in. vertical compound engines, developing 390 hp each at 114 rpm, drive twin screws. Dredging equipment consists of two 15-in. centrifugal pumps, each driven by a 12×22×14-in. throttle-governed vertical compound engine developing 195 hp at 215 rpm. Two cross-drum water-tube boilers with interdeck superheaters supply 165-psi 50-F-supht steam for propulsion, dredging and auxiliary equipment. For auxiliaries, pressure is reduced to 125 psi.

Principal auxiliaries are: feed, circulating, fresh-water, sanitary, drinking-water and wet-air pumps, burner pump for fuel oil, turbine-driven hydraulic pump for steering-gear operation, a 20-kw engine-driven generator set, a 10-kw turbine-driven generator set, ammonia compressor, hoisting engines for raising and lowering the suction pipes, and two evaporators for distilling feedwater. These are the important items from the standpoint of steam consumption. In addition, there are such items as: bilge, fire and fuel-transfer pumps, hydraulic pump for hopper-gate operation, anchor windlass, capstan, boat hoist, etc, which are used infrequently and have relatively little effect on over-all economy.

Propelling and pump engines exhaust

Fig. 1—U S Engineer Department hopper dredge Savannah

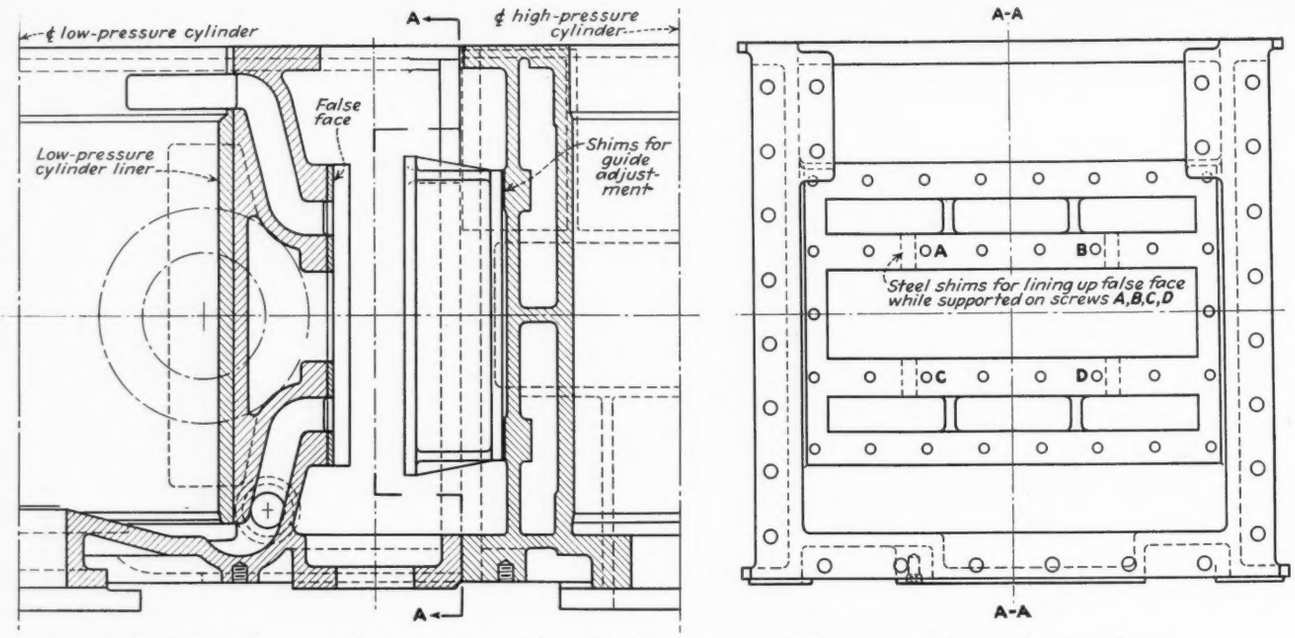


Fig. 2—False faces on valve seats of propelling-engine low-pressure cylinder were installed as described in text

directly to a condenser with a normal vacuum of 26 in. Hg. The auxiliary equipment, with the exception of the draft fans on the oil burners, exhausts into a common line against a regulated backpressure of 15-16 psi. The draft-fan turbines exhaust to the condenser through a separate line on which about 2-psi backpressure is maintained.

With the advent of war and a large shipbuilding program, involving a considerable diversion of labor, materials and equipment, operators of older dredges faced the same problem confronting many small manufacturing plants, namely, maintaining their plant with materials and equipment readily obtainable and at minimum expense, and at the same time increasing the plant output and lowering operating costs.

The first step toward solving this problem was the purchase of a feedwater meter and various thermometers and gages. Numerous simple operating tests were conducted and piping and equipment were studied from the angle of improving heat balance and eliminating avoidable radiation losses. These tests and studies showed:

1. Boiler performance, allowing for wide load fluctuations, was quite good.

2. About one-third of total steam went to auxiliary equipment which had a high steam rate and could not exhaust directly to the condenser.

3. Backpressure on the feedheater fluctuated considerably with a corresponding variation in feed temperature.

4. The maximum generator load was only about 75% of capacity and a large part of this consisted of high-wattage lamps in those areas where high-intensity lighting was of no particular value.

5. Numerous direct-acting steam pumps with pressure governors operated under widely varying loads and thus were much larger than necessary for average needs.

6. Excessive makeup required was caused to a large extent by small losses at rod and stem packings of pumps and engines and packings on globe valves.

7. There were a number of bare traps, fittings, pump cylinders, and steam chests and also some short sections of bare steam pipe.

8. Boiler blowdown appeared to be greater than necessary, considering that makeup was distilled and treated and lubricating oil was held to a minimum.

9. Because mud in the water fed to the evaporators made it difficult to keep coils clean and because of losses mentioned above, the evaporators, designed for 75-psi operation, could not supply enough water and city water was added to the feed tanks each weekend. There was ample heat available from exhaust steam to operate the evaporators.

10. For reasons unknown, the heating system for the quarters was origining system for the quarters was designed to take live steam from the auxiliary line, through a reducing valve.

Because of ice, fogs and storms on the Great Lakes from December through March, dredges of this district are laid up during these months and all repairs except those requiring major shop equipment are made by the crew. During the early part of December, 1940, all equipment was opened for examination and the following conditions were noted:

1. The propelling-engine low-pressure cylinders were considerably worn; as they had been rebored several times, it was considered necessary to install liners and new pistons. The high-pressure piston valves and the low-pressure slide valves were worn and scored.

2. Clearance between dredge-pump casings and impellers was excessive and packing sleeves on impeller hubs were badly worn.

3. Edges of the circulating-pump impeller vanes were badly eroded and clearance between vane and casing was much too large. The engine driving the pump needed complete reconditioning.

4. Both steam and water valves and also the buckets and piston rods of the wet-air pump were in bad condition.

Work on the low-pressure cylinders of the propelling engines had been expected and the liners, pistons, bull rings and piston rings had been purchased in advance. A local machine shop received a contract for boring the cylinders, turning, installing and finish-boring the liners. Pistons, rods, bull and piston rings were installed by the engine-room force.

Careful examination showed that low-pressure slide valves and seats were worn so much that it was impossible to bring the valve face against the seat without springing the stem. Accordingly, we decided to install false faces on the valve seats. For each valve seat, we made a Masonite template with openings $\frac{1}{8}$-in. smaller than the original ports on all port edges. Templates were then solidly wedged against the seats and a hooked scriber run around the port edges against the template. We then cast false faces and rough machined them; as the finished castings

were to be only ⅜ in. thick, we stress-relieved them before final planing, to prevent warping. Ports were machined to approximately the location of the scribed lines on the templates, with a small allowance for finish-filing.

Seat castings were then laid out, drilled and countersunk for attachment with ⅜-in. brass screws. These were then wedged in place and the holes in the valve chest drilled with a close-quarters air drill and then tapped. No attempt was made to true up the original valve seats. Instead, the false faces were supported on four screws about 12 in. apart, near the center, by means of thin steel shims between the castings and original seats and lined up with the machined and adjustable guides in the back of the valve chests. We then carefully tightened the four screws and rechecked alignment, using inside calipers.

The remaining screws were then inserted and run in far enough to bring the surface of the heads below the seating surface but not far enough to distort the castings. We then checked seating surfaces with a straight edge. Next, a thin paste of Smooth-on was forced into the joint between the castings and the old seats, using a putty knife inserted through the ports and around the outside edges. The slide valves, previously planed, were then lowered into place and pressed solidly against the false seats by steel wedges between the backs of the valves and the guides, care being taken to keep the valves parallel to the guide faces.

After the Smooth-on had set, we pulled out the valves, tightened all screws and filled some small voids in the Smooth-on. Valves were then coated with Prussian blue and moved over the false-seat faces; high spots found were removed with a scraper made from the squared end of a 12-in. flat file. Edges of ports were then finish-filed and valves assembled. On later inspection we found seating action perfect.

As the high-pressure valve chests are fitted with removable liners, these were removed and rebored. Incidentally, these had been made such a tight fit that the ordinary strongback and draw bolt failed to start them and we had to resort to heating the outside of the chest with an oil-burning torch and packing the liner bores with dry ice. Valve plugs were turned down, cast-iron collars were shrunk on and turned and polished in place.

After completion of valve and cylinder repairs, the main, connecting-rod and crosshead bearings were refitted and the valves were adjusted essentially by the method described in POWER, May, 1941. The setting was later checked with an indicator and the load properly adjusted between high and low-pressure cylinders.

The dredge pumps are fitted with abrasion-resistant plate liners in the front and back heads. We found that wear on these liners had been unusually uniform but was slightly greater at the outer edge. To restore proper clearance and have liners and runner shrouds exactly parallel, we welded up the countersunk bolt holes, ground them flush and redrilled from the opposite side. Tar-paper liners were inserted between casing and liner to restore standard $\frac{1}{16}$-in. clearance. Packing sleeves on runner hubs were also renewed.

New throttle-valve liners for the drag-hoisting engines were purchased with the bore $\frac{1}{16}$-in. less than standard and the old pistons were turned down to suit and fitted with new rings.

The circulating pump impeller is open, 27 in. diameter, with 6.75-in. vanes. To eliminate excessive slip caused by eroded blades and excessive side clearance, we faced off the impeller on both sides and fitted plate liners in both back and front heads. Pump shaft, shaft sleeves, and bearings were also renewed. The engine driving the pump was dismantled, the cylinder rebored, valve seat planed and piston rings and valves renewed. In addition, we machined the crankshaft, rebored the guides, renewed the main, crank, and crosshead bearings, and fitted a new crosshead pin and slipper brasses.

We found the backpressure valve to be too small, which had made partial manual control necessary. Installation of a 5-in. diaphragm-controlled valve made it possible to hold backpressure within close limits. Average feedwater temperature is now about 243 F, which represents a gain of approximately 10 F.

Steam and water valves of the wet-air pump were reseated, buckets were turned down slightly and bronze rings shrunk on to suit the cylinder liners. We renewed piston rods and packing.

To eliminate use of live steam for the evaporators and the need for frequent addition of city water to the makeup tanks when in port, we attacked the problem from the angles of more efficient operation, increased output, and decreased consumption. To

Fig. 4—New liners fitted in circulating-pump casing eliminated excessive slip

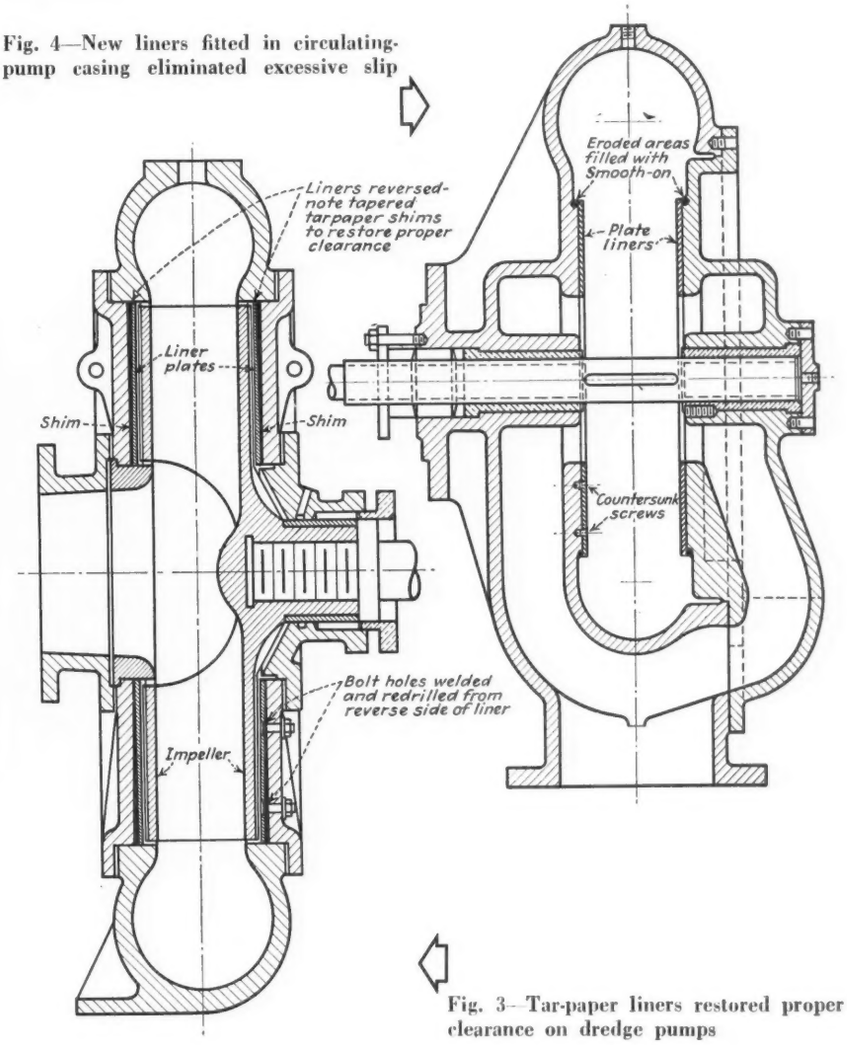


Fig. 3—Tar-paper liners restored proper clearance on dredge pumps

increase evaporator-heating-coil effectiveness we installed a settling tank to eliminate the excessive mud in the evaporator feed resulting from agitation incident to dredging. An evaporator feed heater was fabricated from a 30-in. length of old 15-in. dredge pipe by welding a head on one end had a flange on the other. A cover of ¾-in. steel plate was bolted to the flange. Pipe couplings welded to this head carry special unions for connection to a U-shaped copper heating coil.

The evaporator shells were insulated thoroughly and the size of the steam line to the heating coils was increased to take care of the greater volume of steam caused by switching from 75-psi operation to exhaust at 15 psi. We successively decreased boiler blowdown to find the minimum needed to maintain satisfactory concentrations. All valve and piston-rod stuffing boxes were gone over carefully and the bulk of the leakage eliminated. As a result of these changes, the evaporators now produce sufficient makeup water from heat formerly wasted and raw water is no longer required. A saving in amount of feedwater treatment required also resulted.

We accomplished the change from live- to exhaust-steam heating in the quarters with little difficulty. Tees were installed in exhaust and heating lines and the necessary cross-connection provided, leaving the old reducing and relief valves intact for emergency use. As the pressure is now 10-15 psi lower than formerly carried, some rearrangement of radiators and return lines was necessary but this was easily handled with material at hand and at small expense.

To further reduce the amount of auxiliary steam required, electrically driven piston pumps with hydro-pneumatic tanks and pressure switches were installed to replace the direct-acting steam pumps formerly used for wash water and sanitary service. A small electrically operated centrifugal pump for supplying water to the ammonia compressor and condenser, and main engine guides and bearings, was also installed. By carefully adjusting the wattage of all lamps to the requirements of the particular locality, we found it possible to supply the necessary current for these electric pumps without any increase in average generator load.

As a final step in improving economy, all steam-pump cylinders and steam chests were covered with magnesia and sheet iron and numerous short sections of pipe and flanges were also insulated.

Because of difficulties in securing delivery of certain items, it was not possible to complete all the work described before putting the dredge back in service on April 1. A considerable part of the work was done, as conditions permitted, during the operating season and thus the results listed below do not reflect all the savings for a full year.

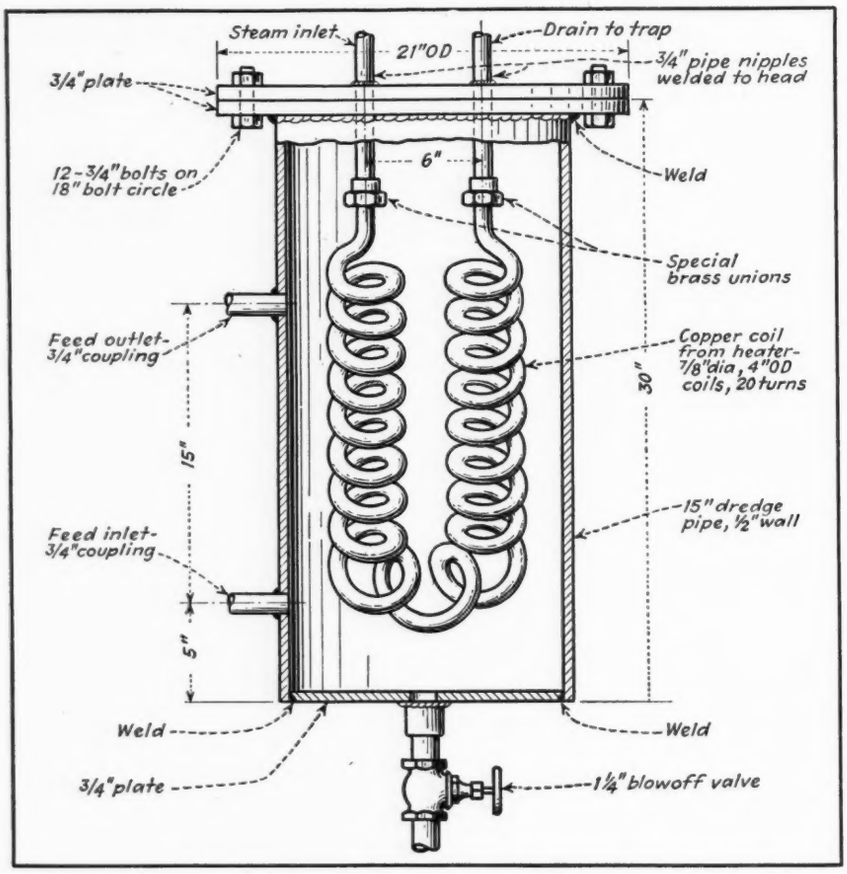


Fig. 5—Evaporator feedheater made from old dredge pipe and copper heating coil

To have an accurate basis for comparison of operating conditions during various periods, we began a weekly engine-room-report system. Readings of condenser vacuum, circulating water, condensate and heater-discharge temperatures, auxiliary exhaust pressure, generator amperes, CO_2, fuel-oil temperature, and fuel-oil and water flow are recorded at 2-hr intervals. Charts from the recording instruments supplement, and to some extent duplicate, this report. We believe this system assures reading at regular intervals and what is more important, insures prompt adjustments when readings indicate the necessity. Apparently this has proved sound reasoning.

The results obtained can be summarized briefly by comparing operating records for the calendar years 1940 and 1941, as all changes were made in 1941. The figures are:

	1940	*1941*
Total fuel-oil consumed, gal.....	888,895	814,612
Total miles run....	19,732	20,314
Total yardage dredged	712,148	847,094

This represents a saving in fuel oil of 74,283 gal or 8.4%, an increase in mileage of 942 miles, or 4.9% and an increase in yardage of 134,936 or 18.9%. Without considering increased mileage and yardage, this represents a fuel saving of $3800, at the current price for oil of 5.2 cents per gal.

In general, yardage pumped cannot be taken as an absolute criterion of dredge performance as output will vary widely according to the character of the material pumped. In this case, however, we believe the comparison to be fairly accurate, because the Savannah worked in the same harbors both years and the number of days worked in each locality was approximately the same for both seasons.

Much credit is due to the officers and crew of the vessel both for their efforts in making the necessary mechanical changes and their interest in improving operating procedure. The Savannah is operated by the Buffalo, New York, district. Lt Colonel George R Goethals is District Engineer. William F Goodson, Senior Supt, supervises plant operation, assisted by the writer. Capt Harry J Ruddy is master of the Savannah and William C Dahlke is chief engineer.

Need **MORE STEAM** *from Your Boilers?*

J O G Gibbons follows up Harry Spring's January article with some pointers on high-rating operation of oil-fired hrt boilers

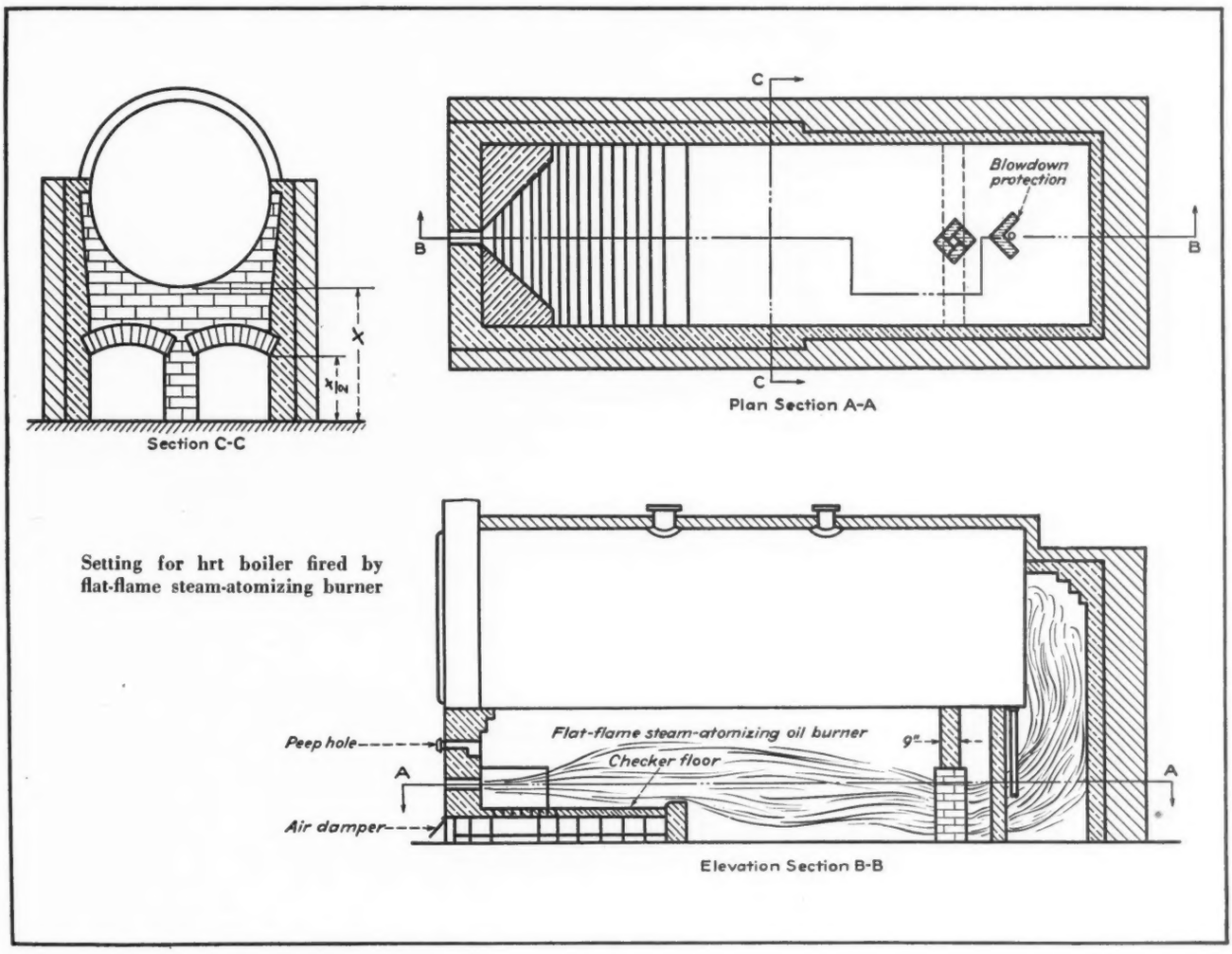
▶ THE ARTICLE BY HARRY SPRING, "Need More Steam from Your Boilers?" (January, 1942, pg 99) calls attention to a matter which, from now on, will become increasingly important. Undoubtedly the exceptional demand for industrial power will create a strong tendency to push the performance of boilers which have hitherto operated at moderate ratings.

In the case of water-tube boilers there is not much danger, provided, of course, that they are in good condition and properly operated. Hrt boilers are quite a different matter especially as these boilers generally have low settings. As Harry Spring rightly says, forcing hrt boilers does not represent good practice. However, it can be done and I have seen such boilers operating at 200% rating with flat-flame steam-atomizing oil burners in comparatively low settings.

Under normal conditions, this high rating would not be recommended; it is rough on large boiler drums. But today we are at war and it may be necessary to stretch our ideas of good practice to meet the emergency needs of the moment, while doing everything possible to make such high-rating operation safe.

When installing oil burners under hrt boilers, great care should be taken to keep the flame from having a blowtorch effect on the seams and rivets of the drum. This can be done best by keeping the flame down as indicated in the sketch below. Firebrick arches, as shown, have been installed under a number of hrt boilers fired with flat-flame steam-atomizing burners and in every case with which I have been familiar the results have been highly satisfactory.

With this arrangement there is rarely any lack of combustion space even with low-set boilers because when the bridgewall is cut down and the oil burner installed, the whole length of the drum becomes the long dimension of the combustion space. The only likely trouble comes from the flame being too near the drum, but with a flat-flame burner and a brick arch these difficulties are eliminated to a great extent and operation at high ratings is possible.



Setting for hrt boiler fired by flat-flame steam-atomizing burner

PRACTICAL AIDS TO OPERATION

Welded Test Jack Speeds Weld Tests

THE TRAINING OF HUNDREDS of new welding operators throughout the country to meet war demands has made it necessary to test the work of new welders faster and more carefully than ever before. To speed weld tests, technicians at the B H Leonard Welding School at St. Louis, Mo., and the Midwest Piping and Supply Co, built the all-welded test jack shown in the photo.

This device consists of a sturdy frame built around a hand-operated hydraulic jack. It is used for making free-bend, side-bend, and band-bend tests on weld coupons.

The hydraulic jack is rated at 8 tons, so the frame has to be sturdy to stand the strain. Side and top members of the frame were made of mild steel, 6 in. wide and ½-in. thick. Side pieces are approximately 2 ft long and the top members 9 in. Bottom base plate is 9 in. square and 1 in. thick. The male member of the die is 1½ x 2 x 6 in. The upper end was machined on a ¾-in. radius and the lower end welded to the upper surface of the jack. The female part of the die is also 2 in. thick and its curved portion was machined on a $1\frac{3}{16}$-in. radius, with the lower corners rounded as shown. In the photo the male member is seen forcing the ⅜-in standard test coupon into the female side of the die.

Cleveland, Ohio A F DAVIS
Lincoln Electric Co

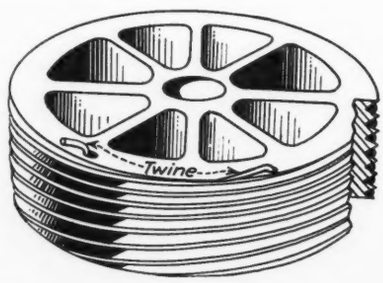
Improved Power Factor Cures a Lot of Troubles

IN AN INDUSTRIAL PLANT with a complicated production setup, trouble was experienced with electric-eye-controlled relays operating too slowly or too quickly, motors overheating, ac-dc rectifiers failing to function properly and contacts burning badly on process-control oil switches. After considerable investigation a recording voltmeter was installed at the load center where trouble was being experienced. This showed that instead of the voltage being approximately 115 and 460 it was down to 106 and 425 volts. It was also apparent from the speed of some of the motors and the fluctuating load under which they operated, that the power factor was low, even though we did not have any means of measuring it.

To improve power factor and voltage regulation we installed a 60-kva 440-volt 3-phase static condenser at the troublesome load center, which eliminated all of the troubles. Not only does the voltage remain near normal, it does not fluctuate with load as it did previously. The electric-eyes all give accurate control of process operations and rectifiers that supply pulsating current to vibrators do their job well.

Several oil switches in the process-control circuit open and close about 15 times per minute. Contacts on these switches burned badly and had to be replaced weekly. Installation of the static condenser has eliminated most of the burning on these contacts. Apparently the static condenser serves the same purpose as a condenser connected in multiple with a contact to absorb the inductive kick when it is opened. It is well known, however, that improving the power factor with static condensers reduces the strain on oil circuit breakers when they open faulty circuits and our experience indicates similar effects with contactors opening control circuits. This benefit is generally overlooked when considering installing capacitors.

Trenton, N. J. R O CUMMINGS



Twine Packing Makes Valve-Seat Tight

A SUCTION-VALVE SEAT IN one of our direct-acting feed pumps worked loose. Before the fault was detected the thread was badly worn in the hole for the seat in the valve deck. The new seat could not be properly tightened into place so I applied a twine packing to the thread in the seat. First, I drilled ⅛ in. hole

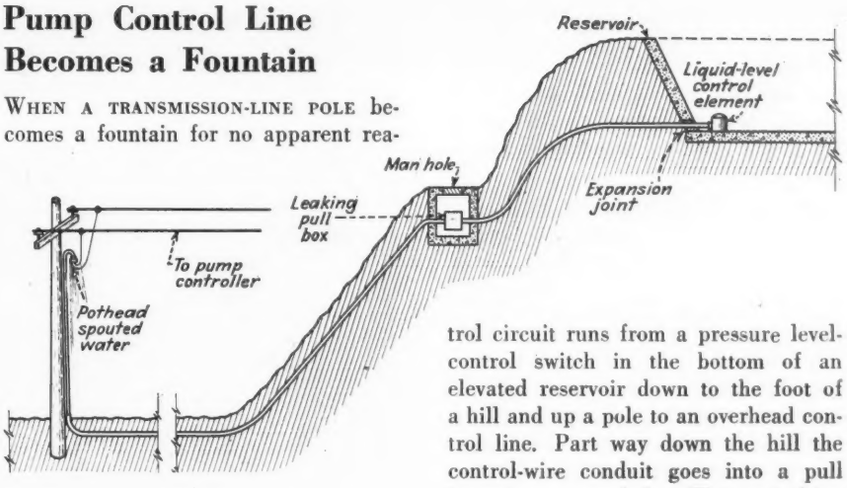
through the seat near each end of the thread, as in the diagram.

I then put the end of a piece of twine through one of the holes and fastened it securely by driving in a soft wooden plug from the bottom of the seat. After winding the twine in the valve-seat thread I put the free end through the other hole, pulled the twine tightly in the thread and held it there by driving another soft wooden plug in the hole. The threads in the deck and on the seat were given a good coat of white lead and the seat tightened in place. The twine did the trick, for I was able to get a good tight fit of the valve seat in its deck that gave no further trouble. When the job was completed I cut the twine clean from the top of the seat so as not to interfere with the valve making tight contact with the seat.

Riverdale, N. Y. ALEX GRAY

Pump Control Line Becomes a Fountain

WHEN A TRANSMISSION-LINE POLE becomes a fountain for no apparent reason, as happened on a pump installation, it is something to talk about. As shown in the diagram, the pump-control circuit runs from a pressure level-control switch in the bottom of an elevated reservoir down to the foot of a hill and up a pole to an overhead control line. Part way down the hill the control-wire conduit goes into a pull box in a manhole. Water leaking through the reservoir wall around the conduit followed it downhill into the manhole. The pullbox cover had been put on without a gasket and the water leaked in, ran down the inside of the conduit and out of the fitting near the top of the pole. This is just another instance to prove that anything can happen in practice.



Roanoke, Va. S H COLEMAN

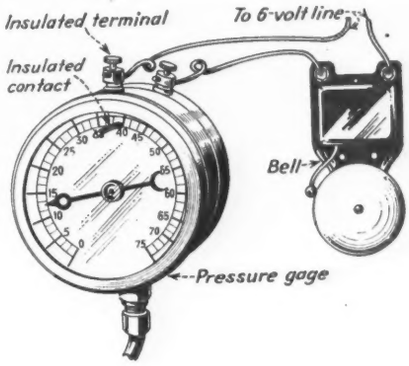
Ripping Tool Reduces Construction Costs

AROUND OUR PLANT it is often necessary to tear up old paving or other hard-packed surfaces to move or lay buried pipe lines, or for new construction work. Since the majority of the jobs are too large for pick-and-shovel work, and too small to warrant employing a mechanized digger, we made the tool shown in the photo by welding, designed to operate from the drawbar of a small tractor or truck.

This tool, fitted with convenient handles, consists essentially of a 4-ft length of extra-strength 4-in. pipe, equipped with an interchangable digging tool. The two types of digging teeth shown, cut out of ½-in. steel plate, sharpened and hardened at the pointed ends, were found to give the best results for all average work. The steeper-dipping point is used for deeper work, and on jobs where an extremely tough surface is being ripped up. The other tooth is best suited to breaking and lifting slabs of hard material, or where a more shallow cut is desired.

A ½-in. bolt passed through the body of the pipe holds the digging tooth firmly in the torch-cut slot while the tool is in service. A heavy steel lug welded to the front end of the pipe provides a firm connection to which the pulling cable can be fastened.

Pomona, Calif. GILBERT M WILSON



Pressure Gage Warns of Trouble

THE UNDERFEED STOKER IN OUR PLANT is driven by a hydraulic ram using pressure oil. If the stoker plunger becomes heavily loaded for any reason there is danger that the oil pressure behind it will build up high enough to bend the pusher rod. To obtain a warning before this condition is reached I connected a gage to the pressure-oil line going to the stoker cylinder. After some experimenting I found the maximum safe operating pressure for the cylinder, which in this case was 35 psi.

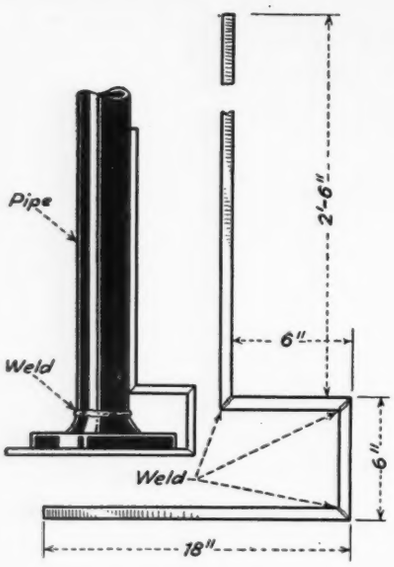
Then, I located a light metal strip so that it would contact the gage pointer when it reached the 35-lb mark. I insulated this metal strip from the gage dial and connected it to a terminal in the gage casing. A second terminal

contacts the metal in the case. These terminals connect to a bell and a 6-volt circuit, as shown. Now when the pressure starts to go above 35 lb we hear about it and can take steps to correct the trouble before something happens to the stoker.

Chicago, Ill. PAUL PLANCK

Tool Aligns Pipe and Flanges for Welding

THE DIAGRAM SHOWS a squaring device that I built and found to be a great timesaver in welding work. In the fabrication of pipe by welding it is used to square up flanges as shown. The flange,



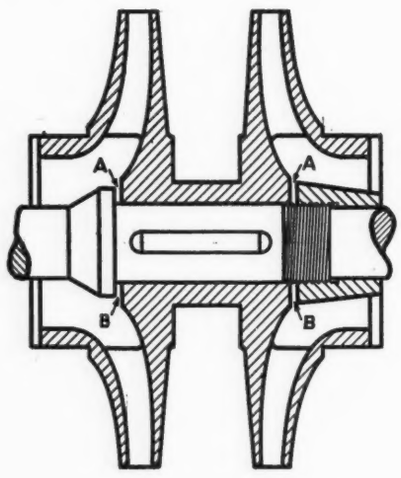
either slip or welding-neck, is set up on the pipe, and the square applied. From there on welding procedure is standard practice: tack weld the flange at four places and complete the job.

A square with the measurements shown in the diagram can be used to line up flanges on pipe ranging from 2 to 12 in. in diameter. In making the square great care must be taken to insure that it forms a perfect 90-deg angle.

Waynesboro, Pa. JOSEPH M MARVIN

Machining Pump Impeller Stops Vibration

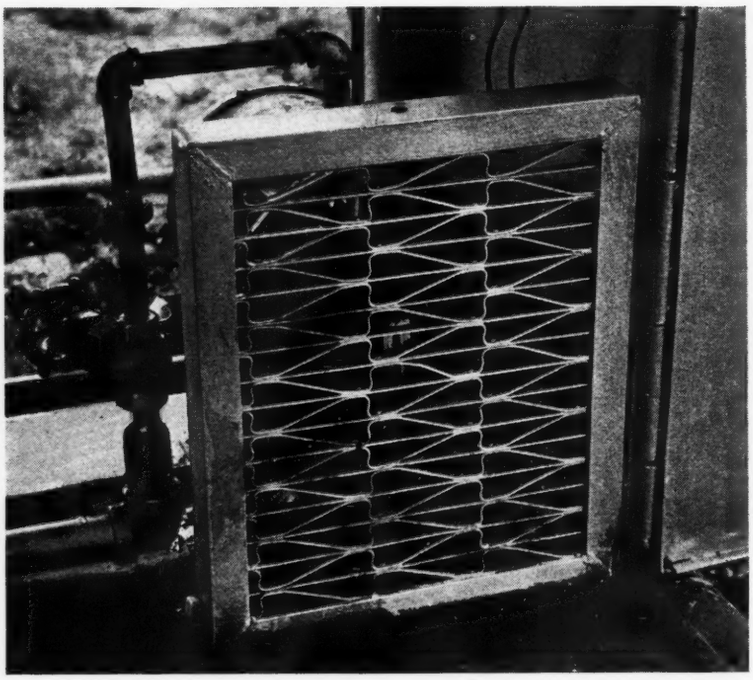
MACHINERY RUNNING AT HIGH SPEEDS vibrates seriously if unbalance occurs in the rotating element. Vibration in a 3600-rpm centrifugal boiler-feed pump was traced to impeller unbalance caused by a bent shaft. The impeller was removed and the shaft straightened in a lathe. When returned to service the unit still vibrated badly and when dismantled the shaft was found bent as before. It was at first thought that end clearance was insufficient between the bearing for shaft expansion.



The trouble was finally located as shown at *A* and *B* in the figure. Impeller hub faces were not parallel with shaft collar and clamp-nut faces. Each time the nut was tightened it caused a slight bend in the shaft.

After the faces were machined true the pump operated without vibration. This pump was especially susceptible to the slightest out-of-balance because of the high speed, small shaft, and distance between bearing supports, therefore required very close static and running balance.

FIELD EDITOR



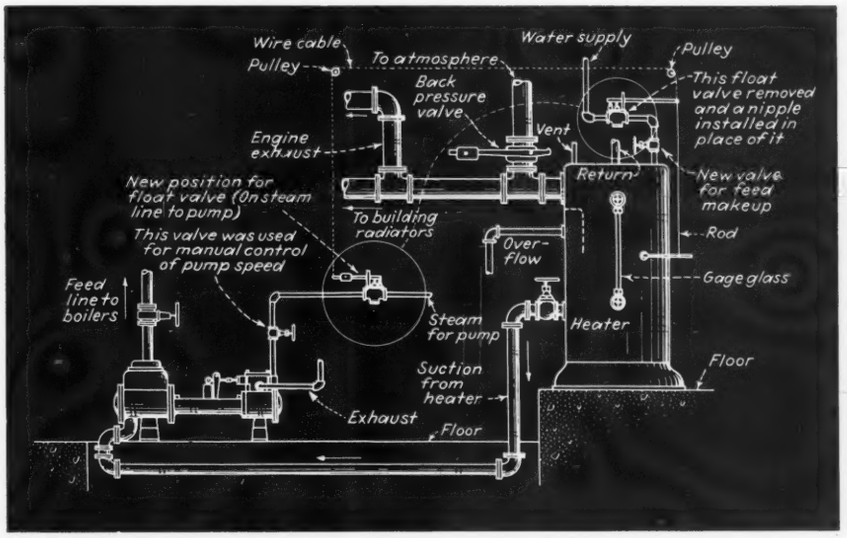
Guard for Emergency Lighting Unit

A SMALL TURBO-GENERATOR SET, used for standby service at a generating plant, was placed where there was danger of the operator contacting the turbine casing when he entered the small house sheltering the unit. To protect the attendant against possible injury by coming in contact with the hot turbine, we made a shield of angle iron and light steel floor mesh to stand in front of the turbine, as in the photo. Two holes drilled through the angle iron fit over pins set in the house wall, while a set screw and locknut in a bracket on the turbine base engages the other side of the guard and holds it rigidly in place. When it is necessary to work on the turbine, the set screw is backed out, the guard swung forward slightly, slipped from the pins, and the turbine cleared for servicing.

Houston, Texas CHARLES C LYNDE

Improves Gage-Glass Visibility

MANY SCHEMES HAVE BEEN TRIED to improve the visibility of water level in boiler gage glasses. The diagram shows one that I use with good results.



Control Valve Shifted to Save Water and Fuel

BY TAKING A FLOAT-CONTROL valve out of the cold-water supply line to our heater and placing it in the steam line to the feed pumps connected to this heater we improved operation greatly.

Our feedwater heater was hooked up according to the manufacturer's specifications (see sketch) when it was first installed some twenty years ago. Evidently they thought it more desirable to keep the water level constant in the heater than to keep it constant in the boilers.

Here is how the original worked: The feed pumps were manually controlled by the fireman. He would set the pump for a certain speed. In the early hours when everything on the line was heating up there would be quite a flow of returns coming back. Later on they would slacken because equipment would be getting hotter, so less condensate would return. With less returns and the pump operating at the original speed, the water level in the heater would drop. This would cause the float valve to operate and allow more cold water to enter the heater needlessly.

At other times the reverse would happen; the fireman would remember and slow down the pump. More equipment would be put on the line, thus increasing the returns. In this case the pump would not be running fast enough to handle the returns, so the heater would overflow to the sewer, wasting good hot water.

The results were similar if the fireman allowed his boiler pressure to fluctuate. He may have set his pump for the proper speed when the pressure was about 150 lb. Then if his steam dropped the pump would slow down, the heater fill up and overflow. If the steam went up to 160 lb the heater would be emptied faster. Then the float valve would open up, admitting cold water. This in turn would raise the level of the boiler water.

To clean up this mess, I simply took the float valve out of the water supply line and placed it in the steam line to the pump, controlling it with a light cable from the heater float. Our troubles ended. Extra feed for the boiler or make up water was obtained by "cracking" the new valve in the water line to the heater.

Englewood, N. J. R BOETTINGER

Shape Change Stops Oil-Ring Sticking

ON SOME OF OUR SLEEVE-BEARING-equipped motors we had trouble with the bearings heating. After considerable search we discovered that the oil rings were sluggish in their travel with the shaft. When the motor started, the ring would apparently come up to full speed with the shaft and then gradually slow down to a point where the bearing did not get sufficient oil. For some reason the ring would work to one side of its slot in the top of the bearing until there was practically metal-to-metal contact.

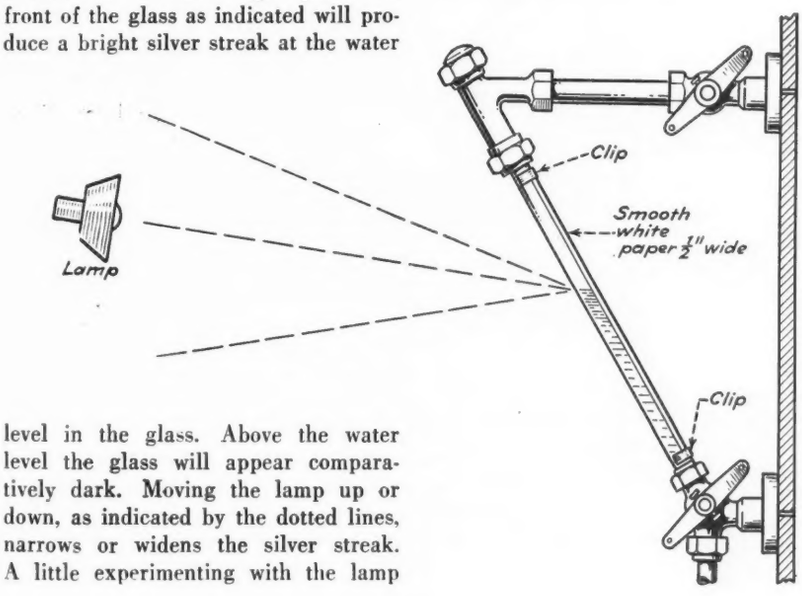
We never did find out just what caused this. It may have been that the motor was not set exactly level, or that the armature shaft was out of level because the center of one bearing was lower than the other. A cure seemed to be easier to find than the cause so we proceeded on this course.

The oil rings were apparently cut from a brass tube and had a rectangular cross-section, so that when they worked against one side of the slot the full thickness of the ring was in contact with the bearing metal. To prevent this we put the rings in a lathe and sloped their vertical sides inward about $\frac{1}{16}$ in. This made the rings about $\frac{1}{8}$ in. narrower on the outside than on the side in contact with the shaft. After this change was made they operated at normal speed and we had no further trouble with bearing heating.

Chicago, Ill. J B MULLINS

On the back of the gage glass fasten a strip of smooth white paper to act as a reflector. A white light placed in front of the glass as indicated will produce a bright silver streak at the water level in the glass. Above the water level the glass will appear comparatively dark. Moving the lamp up or down, as indicated by the dotted lines, narrows or widens the silver streak. A little experimenting with the lamp will show the position for best results.

Windsor, Ont. GERALD M HUGHES



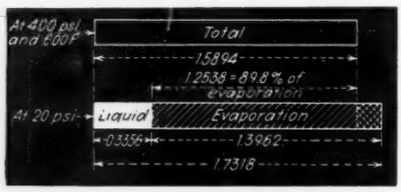
Steam Table Drills—No. 5

Using Entropy

By PHIL SWAIN

THESE articles were designed to help the practical power engineer solve everyday operating problems involving the steam tables. If they were treatises on thermodynamics it would be necessary to spend a lot of time on the subject of *entropy*. It happens, however, that entropy is not much used in figuring everyday operation.

Since I don't think it possible to give an understandable *explanation* of entropy in the available space, I shall not make the attempt except to state two facts: (1) entropy is a mathematical device convenient to designers of engines, turbines and compressors, (2) the entropy of steam does not change when steam is expanded through a theoretically perfect turbine, but always increases when steam is expanded through an actual (imperfect) turbine.



Entropy of steam passing through this perfect turbine remains unchanged at 1.5894. Therefore exhaust steam contains 0.3356 entropy of liquid plus 1.2538 of the entropy of evaporation. Hence dryness of exhaust steam must be 1.2538 ÷ 1.3962 = 89.8%

Now let's use the second fact to solve a simple problem involving entropy and a *perfect turbine*. This perfect turbine is an imaginary machine completely free from friction between the steam on the one hand, and the nozzles, blades, disks, etc, on the other—free from any swirls and eddies that might cause internal friction in the steam—and free from bearing friction or heat loss from the turbine casing. Obviously no such machine has been built, or ever will be, but it gives an ideal with which designers and operators can compare actual machine performance.

Let us assume that this turbine receives throttle steam at 400 psi absolute and 600 F, and expands it down to an absolute pressure of 20 psi. The problem is to find the theoretical steam rate of this turbine and the final condition of the steam. Following data are taken from the steam tables:

	Enthalpy	Entropy
Steam at 400 psi abs, 600 F.....	1306.9	1.5894
Saturated liquid at 20 psi abs.....	196.2	0.3356
Evaporation at 20 psi abs	960.1	1.3962
Saturated vapor at 20 psi abs.....	1156.3	1.7319

Since the turbine is "perfect," the entropy of the steam won't change during the expansion. We must therefore find a condition at which the exhaust steam at 20 psi will have an entropy of 1.5894. At the exhaust pressure the entropy of liquid is 0.3356 (see table) and of dry saturated steam, 1.7319. It is clear, then, that the exhaust is something more than liquid water and something less than dry steam—therefore wet steam. But how wet?

Call the dryness factor of the exhaust steam X. Then the entropy of the exhaust steam must be that of the saturated liquid plus the fraction X of the entropy of evaporation, or $0.3356 + 1.3962\,X$. Since this must equal the original entropy of the throttle steam, we have

$$0.3356 + 1.3962\,X = 1.5894$$
$$1.3962\,X = 1.5894 - 0.3356 = 1.2538$$
$$X = 1.2538 \div 1.3962 = 0.898$$

This means that the exhaust from the perfect turbine will be 89.8% dry, or 10.2% wet.

The next step is to figure the corresponding enthalpy of the exhaust steam. This will be the enthalpy of the saturated liquid plus 89.8% of the enthalpy of evaporation

$$= 196.2 + (960.1 \times 0.898)$$
$$= 196.2 + 862.2 = 1058.4 \text{ Btu}$$

When steam is expanded through a perfect turbine the difference between the throttle enthalpy and the exhaust enthalpy is converted into useful work. Thus, for each pound of steam the useful work in heat units is

1306.9
less 1058.4

248.5 Btu

One horsepower is equivalent to 2544 Btu per hour, so the steam rate of this perfect turbine will be $2544 \div 248.5 = 10.2$ lb steam per hp hr.

One kilowatt hour is equivalent to 3413 Btu per hour, so if the perfect turbine drives a perfect generator its overall steam rate will be

$3413 \div 248.5 = 13.7$ lb steam per kwhr

To see what might be possible with an actual steam turbine, you need to know or assume a *turbine efficiency*, a number expressing the performance of an actual machine in terms of the *perfect turbine*. Suppose this efficiency is 70%, then the steam rate of the actual turbine per hphr will be

$$10.2 \div 0.7 = 14.6 \text{ lb.}$$

Steam rate per kilowatt hour will be

$$13.7 \div 0.7 = 19.6 \text{ lb}$$

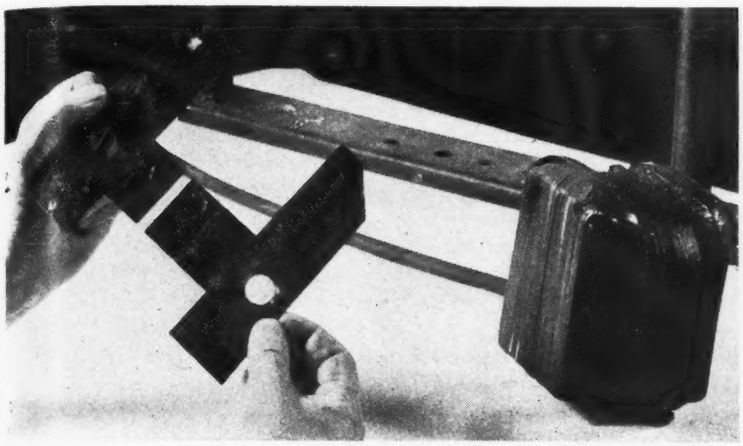
The Headwork Section in April POWER showed how to figure the condition of the exhaust steam of an actual turbine, knowing initial pressure and steam condition, final pressure and actual steam rate.

We divided 3143 by the number of pounds of steam consumed per kilowatt-hour to get the enthalpy drop per pound. This method assumes that heat losses are returned to the steam and is therefore in error to the extent that turbine and generator losses are external.

All references to steam tables in this series are to the "Thermodynamic Properties of Steam" (1936 Edition), by Keenan and Keyes, published by John Wiley & Sons, Inc., New York. Sections reproduced by permission.

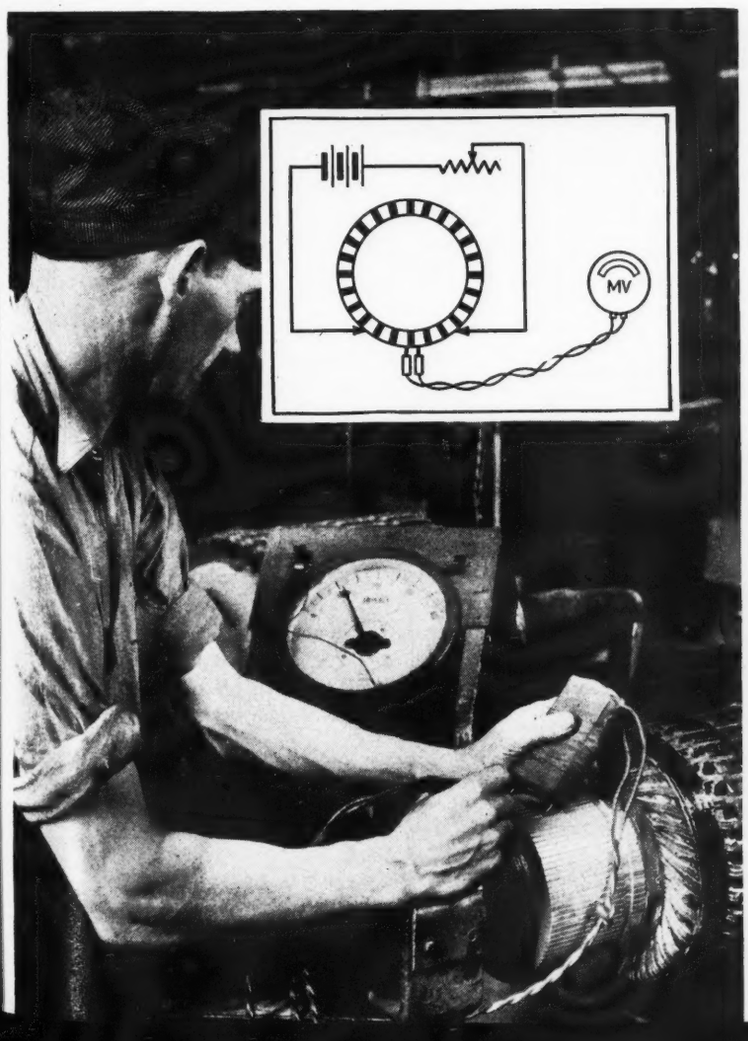
HOW TO TEST AN ARMATURE

PICTURES posed by POWER's photographer in the Newark, N. J. manufacturing and repair dept of the Westinghouse Electric & Manufacturing Co



1 Make a "growler" (right) from a scrap transformer core if one is available. Cut the laminations solid or split H-shape (as shown, left). Stack stampings until cross-section of coil core is 5.25 sq in. Use 150 turns of No. 10 magnet wire for 110 v, 60 cycles; 300 turns of No. 13 wire for 220 v, 60 cycles; or 350 turns of No. 14 wire for 110 v, 25 cycles

2 Place the energized growler directly over the coil slot. Pass an iron or steel object across the *slot* containing the other side of the same armature coil. A short-circuited coil will set up a magnetic flux and pull the test piece solidly against the armature



3 Device for locating open or reversed coils, high-resistance connections or short circuits. Use large double-pronged block to apply a low dc potential across several coils. The small double-prong probe in the man's right hand connects adjacent bars to a millivoltmeter. Voltage drop across two adjacent bars should be nearly constant. A dc ammeter without its shunt can be used

4 Megger measures insulation resistance and tests for grounds. Wrap several turns of bare wire around commutator. Connect megger leads between this point and shaft. Good insulation will have a resistance of not less than one megohm per 1000 volts machine rating

READERS' PROBLEMS

Questions from Our Readers

Does Remelting Injure Babbitt Metal?

Question 1

IT IS OUR PRACTICE *when rebabbitting bearings to melt out the old babbitt, add a small amount of new metal and reuse for the rebabbitting job. Some of the rebabbitted bearings have been giving trouble from overheating and wearing faster than they should. Probably some of* POWER'S *readers can tell us if repeated melting of this metal injures it and what is the cause of our bearing trouble. Oil grooves were cut in the same position in all bearings.*—ORW

Better Cooling for Gas-Engine Cylinders

Question 2

WE OPERATE A NUMBER OF NATURAL-GAS ENGINES, *in which the incoming jacket cooling water has an average temperature of 55 F. The discharge water is thermostatically controlled for a temperature of 160 F. With this arrangement the bottom and top cylinder jacket temperatures are approximately equal to the incoming and discharge water temperatures. We believe that this temperature difference causes injurious and unequal expansion of metal parts. If we install circulating pumps how many gallons per minute per horsepower should be circulated to even the temperature and what hookup and controls should we use?*—OAB

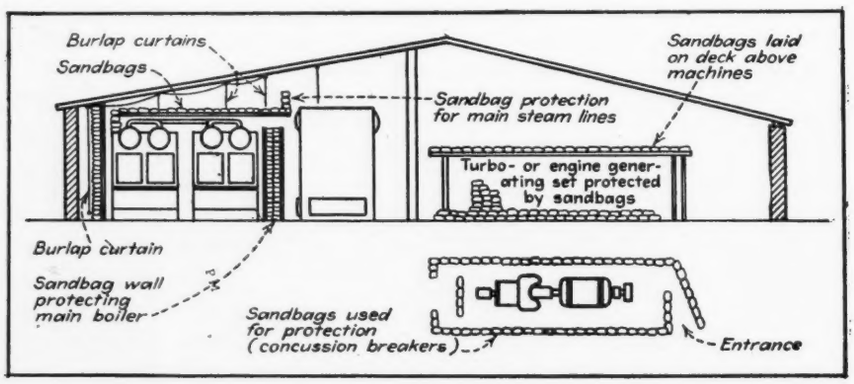
What About Bomb Protection?

Answers to March Question 1

The Question

A number of industrial plants on the Atlantic and Pacific coasts have asked POWER *how best to protect their power facilities against bombing. With no actual experience under fire, American power engineers must apply the lessons to be gleaned from British data with a common-sense realization of the difference in conditions here and in the British Isles.*

Undoubtedly some engineers and plants have given this matter serious consideration, both from the angle of reducing damage from bomb hits and repairing damage and restoring vital services quickly. POWER *readers are invited to submit suggestions and sketches along these lines, particularly where the ideas involved have been put into practice in the form of building and equipment protection and staff reorganization and training for emergency action.*—EDITOR.


Burlap curtains
Sandbags
Sandbags laid on deck above machines
Sandbag protection for main steam lines
Turbo- or engine generating set protected by sandbags
Burlap curtain
Sandbag wall protecting main boiler
Sandbags used for protection (concussion breakers)
Entrance

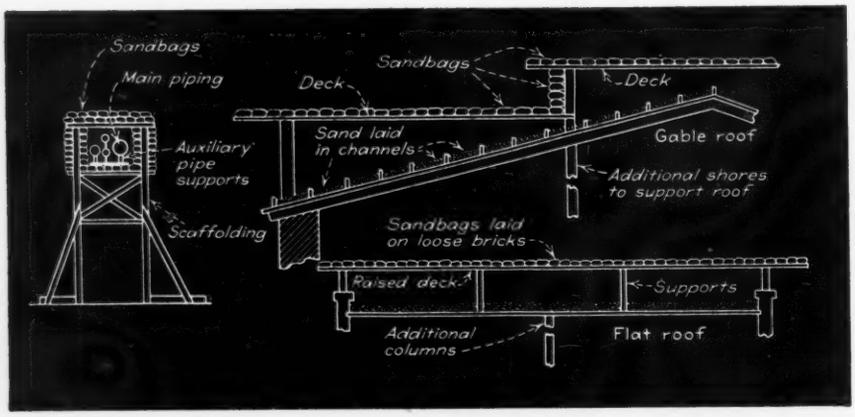
Protect Boiler Room With Sandbags

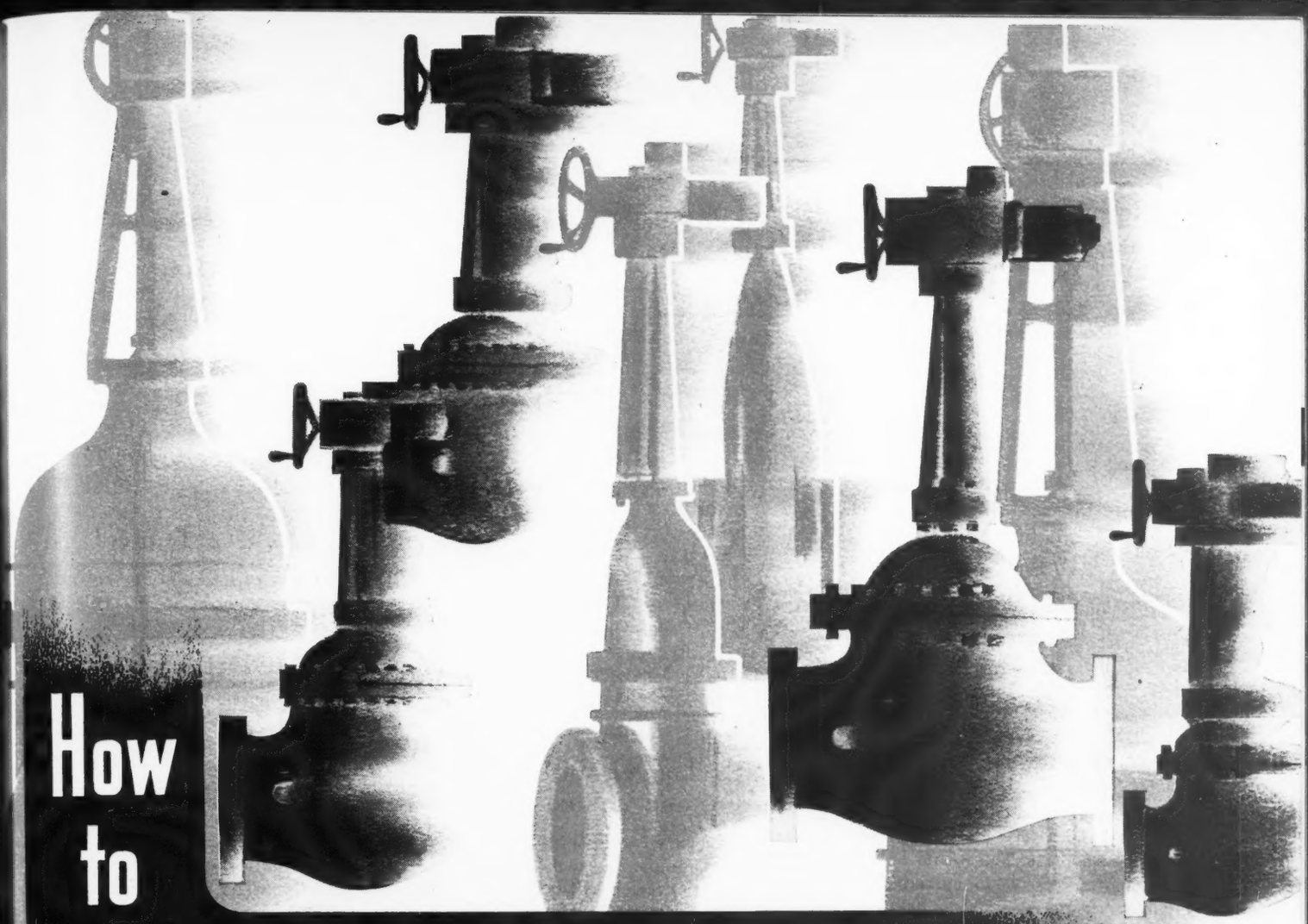
EXPERIENCE INDICATES that attempts to protect plant and equipment against direct bomb hits are impractical. However, steps can be taken to guard against flying fragments and debris which cause much of the damage resulting from a raid. To protect the boiler room the walls can be used to support a deck built above and entirely over the roof. On this deck bricks could be laid loosely, say, about 6 in. apart, and on top of the bricks, sandbags. The roof proper should be covered by loose sand as a protection against incendiaries. Ample protection against fire can be afforded by laying fire hoses at strategic positions.

The walls should be protected by sandbags, leaving the windows free for light and ventilation. Windows should be equipped with heavy burlap curtains. Outside, the windows should be protected by wood plank placed at a downward angle and across in such a manner that shell splinters will deflect away from the windows.

Inside the boiler room a bomb explosion and its resulting concussion would snap the water column, and the pressure gage would become deranged and useless. If the water column gage snapped a panicky person would probably run and leave the boilers; it would be advisable to train operators to rely on the tri-cocks. Removal of the glass column would be an added safety precaution. The safety valves can be relied on to hold the pressure at operating point. It has been found

(*Continued on page* 108)

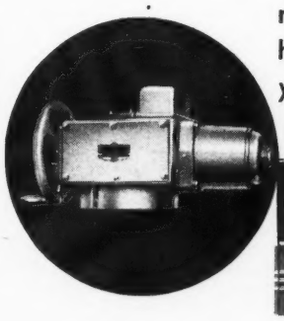




How to Seat all valves Properly

SO THEY WON'T BE DAMAGED BY TEMPERATURE CHANGES OR OBSTRUCTIONS

To seat all valves properly so that they are tightly closed yet safe, simply insist on Cutler-Hammer Motor-Operated Thrust-Seating Valve Control. It seats valves on a proven "controlled-thrust-seating" principle. That means *accurate* seating under normal conditions, and *safety* under abnormal conditions. But most important of all, C-H Thrust-Seating Valve Operators automatically maintain the same degree of tightness as valve parts expand under *high* temperature and contract under *low* temperature. That's why with C-H Valve Operating Units you never get jammed valves, you never have to "back-off" valves . . . *and you won't be faced with shutdown at a time when continued, trouble-free operation is at the highest premium in history.* Insist on Cutler-Hammer Valve Control. For gas, water, high and low pressure steam service—in fact for any valve where fast, reliable operation and accurate seating can save you time, trouble and expense. It offers you every feature—plus. CUTLER-HAMMER, Inc., 1209 St. Paul Ave., Milwaukee, Wis. *Associate:* Canadian Cutler-Hammer, Ltd., Toronto, Ontario.



CUTLER-HAMMER
VALVE CONTROL
C-H

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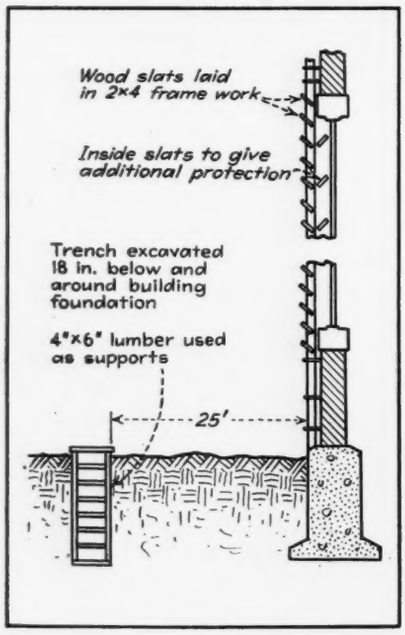
 (Continued from page 106)


Wood slats laid in 2×4 frame work
Inside slats to give additional protection
Trench excavated 18 in. below and around building foundation
4"×6" lumber used as supports
25'

that the pressure gage may be kept in a strong wooden box, and amply protected by sandbags. This would be advisable in power plants operating at the extreme pressures 500 to 2000 psi.

Heavy burlap and wet jute sacks should be hung around the boiler room to lessen concussion. This is preferable around the boiler tops. The steam mains and other piping should be protected by sandbags. Scaffoldings should be erected under the piping, and sandbags should be laid under and around the piping.

Sand should be kept in large receptacles to fight incendiary bombs. Fire hoses should be kept handy.

The turbine or engine room should be protected as shown in the sketch with sandbags built up in tiers between each piece of operating equipment. Scaffolding should be built over the machines and covered with sandbags. The same should be done with the switchboards.

It would also be desirable to have numerous spare parts laid out for easy access in the power plant. The spares should be protected with railroad ties or sandbags. Smokestacks cannot be wholly protected, although some means should be devised to protect the base.

Further protection of power plants could be afforded by excavating a ditch around the main buildings. This would aid in preventing the shock of heavy exploding bombs from carrying the ground tremors to the building walls.

Grand Rapids, Mich. J M GORRIE

Diesel Waste Heat

Answers to March Question 2

The Question

We have a 400-hp diesel engine that operates on loads varying from 150 to 400 hp, with a load factor of about 30% (for a 24-hr day). We now heat hot water for general plant use from 60 to 140 F in a separate boiler. Peak hot-water consumption is 1000 gal per hr and the total water use in a 24-hr day is 8000 gal. At present, the diesel jacket water is cooled in an atmospheric cooling tower. Can we use the engine jacket heat to supply this hot water and what piping and control hookup will take care of the water requirements and maintain the proper conditions in the engine jackets?—FWE

Heat Exchanger With Thermostatic Control

WITH REFERENCE to FWE's diesel waste heat question a hookup such as shown in the sketch will be a satisfactory solution to this problem. It is evident that there is sufficient heat available in the jacket water to meet the existing demand.

Heat absorbed by the cooling water from the cylinder walls is 2900 Btu per hp hour. The hp hours per day is 400 × 24 × 0.3 = 2880. The heat available from cooling water is 2900 × 2880 = 8,350,000 Btu per 24 hours. Daily heat required is 8000 × 8.33 × 80 = 5,334,000 Btu in 24 hours.

With the heat exchanger installed in parallel with the present cooling tower, provisions are made for proper control of the engine jacket temperature. If the water in the outlet of the engine jackets reaches 160 F because no water is being drawn from the general plant hot water system, the thermostatic valve *A* to the cooling tower will open and a portion of the water will be fed to the cooling tower. If the jacket temperature still rises, another thermostatic valve *B* closes at 170 F and all of the jacket water will go through the cooling tower. When a large quantity of water is needed for plant use, a heat exchanger is recommended in order to provide soft water through the engine jackets. A continuous supply of water being fed through the jackets and lost to general plant use would result in scale deposits in the engine jackets.

Hartford, Conn. W R WILLIAMSON
The Maxim Silencer Co

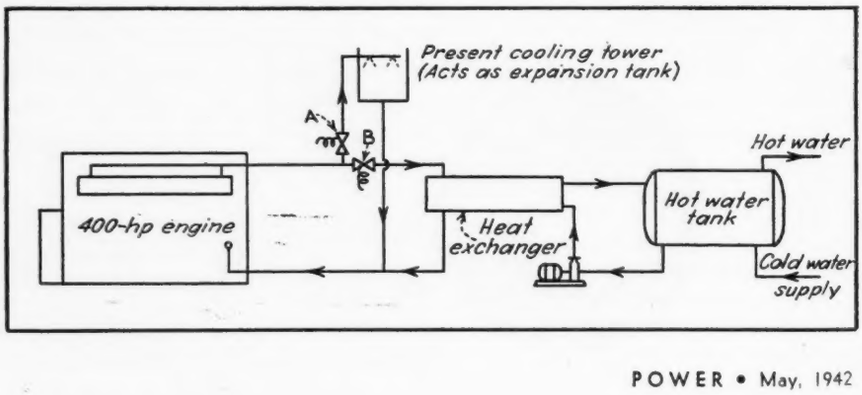
Thermostatic Heat Control

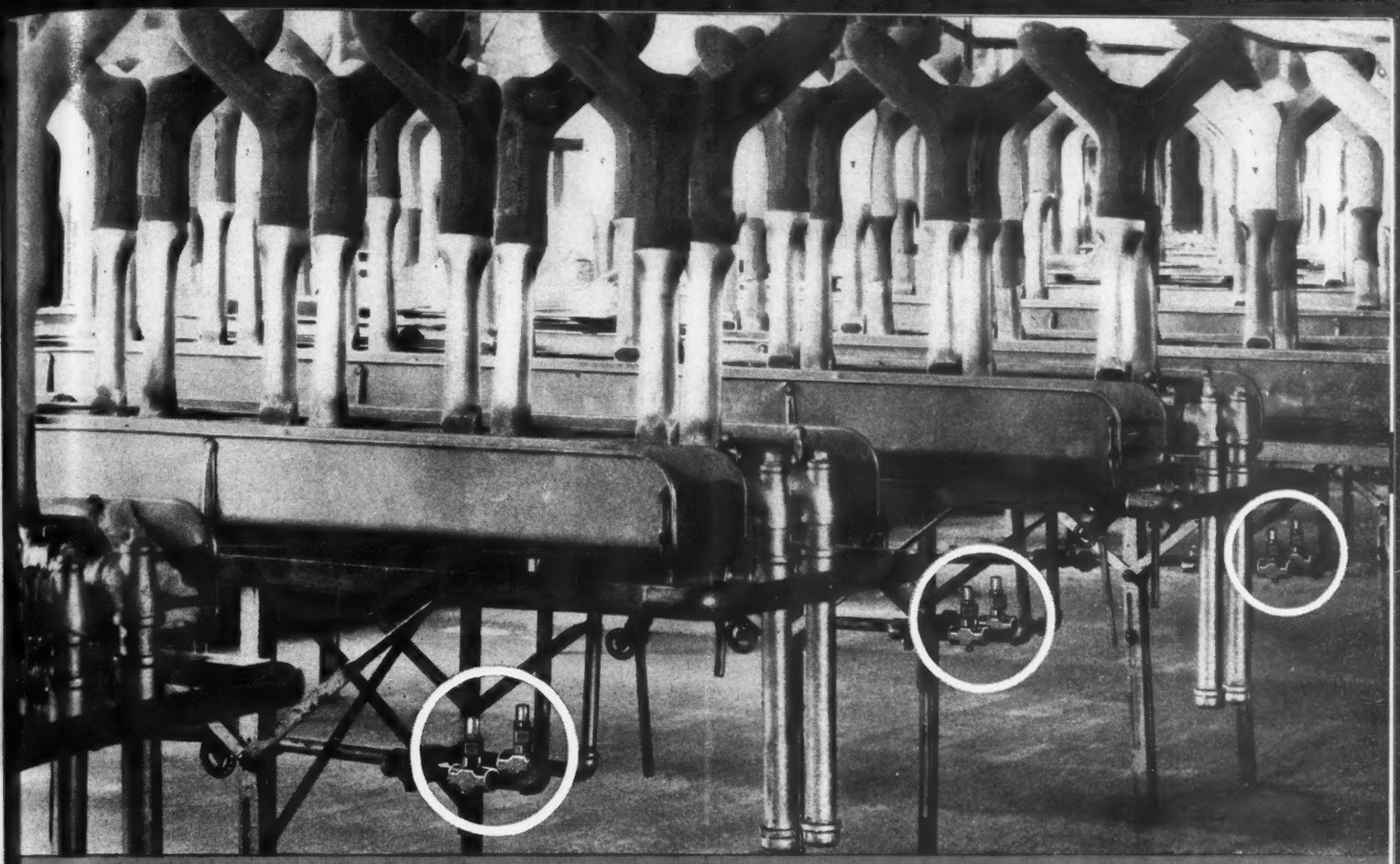
FWE'S STATEMENT of load and operating conditions is rather incomplete. With loads varying from 150 to 400 hp on a 400-hp engine, the 24-hr day load factor would be far in excess of 30% if the engine is in continuous operation. Possibly the engine operates less than 24 hours a day which, with loads of from 150 to 400 hp during the hours of operation, would lower the 24-hr load factor to 30% as stated in the question.

To determine with reasonable accuracy the possibilities of utilizing the heat in the cooling water or the exhaust gases of a diesel engine, very complete data on the load and operating conditions is necessary. The design of the engine also enters into the picture to some extent; for example, if utilization of jacket water is contemplated, obviously a greater percentage of the heat content of the fuel consumed in the engine will be absorbed by the cooling water for an engine with a long water cooled exhaust manifold than if the engine is not equipped with such a unit.

Assuming FWE's 400-hp diesel is an efficient modern diesel in good mechanical condition operating 24 hr per day at a 30% load factor, its average fuel consumption would be a minimum of some .5 lb per hphr or 120 hp × .5 lb per hphr × 24 hr or 1440 lb of fuel per day. An engine input of 1440 lb ×

(*Continued on page* 110)





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"I LIKE the Yarway Impulse Trap better than any other I have ever used. They have been in service on our stocking drying forms for over 2 years and have not required any maintenance," Mr. Tucker reports.

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YARNALL-WARING COMPANY, 100 Mermaid Ave., Phila.

YARWAY IMPULSE STEAM TRAP

19000 Btu per lb or 27,360,000 Btu per day, of which a minimum of one-third or 9,120,000 Btu would be absorbed by the cooling water.

On this basis, with cooling water entering at 60 F and leaving at 140 F, it would be possible to heat 9,120,000 ÷ 80 = 114,000 lb or 13,685 gal to the desired temperature with the heat absorbed by the engine's cooling water, neglecting losses by radiation, etc. This is 70% in excess of the 8000 gal maximum daily requirements, sufficient for probable radiation losses from piping and an insulated storage tank. Storage would be essential because at average load factor of 30% the heat absorbed by the cooling water would not be sufficient to raise the temperature of 1000 gal per hr from 60 to 140 F. To figure the capacity of such a hot-water storage tank, more information on the rate of water use is needed.

Other equipment needed would be a thermostatic controlled valve to regulate automatically the flow of cooling water to maintain the desired outlet temperature which, to allow for losses in piping and storage, would probably have to be held a few degrees higher. Outlet temperatures up to 160 F are not excessive so far as satisfactory engine performance is concerned. Excess hot water to a limited extent could be wasted from the storage tank or diverted to the existing atmospheric cooling tower in event of demands for hot water below normal.

The construction of the engine jackets should safely withstand the pressures at which the hot water must be supplied.

If FWE's engine operated less than 24 hr per day with a higher load factor during its hours of operation, the total heat absorbed by the cooling water for the same hphr output would be somewhat less than above figures for 24-hr running at a 30% load factor. The fuel consumption per hphr of a diesel decreases as load increases and the percentage of the heat of the fuel wasted to either the cooling water or the exhaust also decreases.

The figures given in the foregoing represent what would be the probable minimum in the way of heat recovery in the cooling water under the conditions assumed.

Clayton, N. M. J H Bender

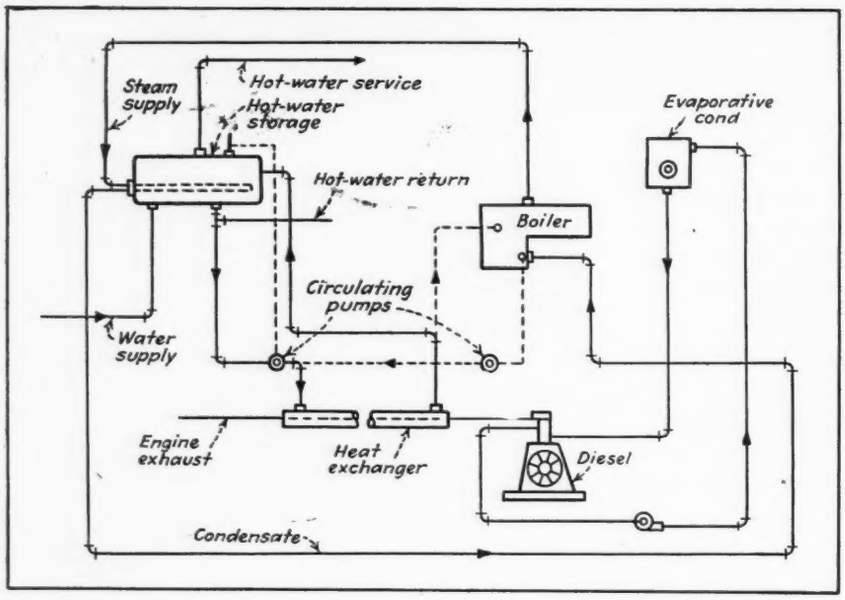
Recommends Exhaust Heat Utilization

Theoretically FWE could heat the quantity of water specified with the available diesel exhaust. I am submitting suggestions which we have found satisfactory in two different places under similar conditions. The alteration took place without interruption at a minimum expense.

In one instance we recirculated the water from the hot-water storage tank through a home-made heat exchanger, thereby absorbing most of the diesel exhaust heat otherwise wasted, and accomplished the desired final hot-water temperature with a ± 7% differential. The only control equipment used was a 2-in. circulating pump, and an aquastat which we installed in the hot-water tank by removing the thermometer and relocating it in a more convenient place in the hot-water line.

In the other instance we recirculated the boiler water with a 1½-in. circulating pump through a heat exchanger. This accelerated evaporation of the steam boiler and reduced our fuel bill, maintaining almost without any fluctuation our final hot-water temperature. In both cases we did not bother to remove the additional Btu available from engine jacket water and left it a single closed circuit. Perhaps FWE would consider a changeover of his present boiler to a waste heat boiler, if the boiler is used for the hot-water heating only.

Schenectady, N. Y. Carl Bachmann



Combinations Possible

FWE's problem can be solved in a number of ways. The cooling water can be discharged to an insulated tank from which plant supply may be drawn, or the water might be heated in a coil suspended in the muffler. If this method is used, care must be taken to avoid an increase in backpressure on the engine. A water jacket could be installed around the exhaust line and the water circulated through this jacket. Heat-transfer rates of the exhaust line must be estimated before proceeding with this method.

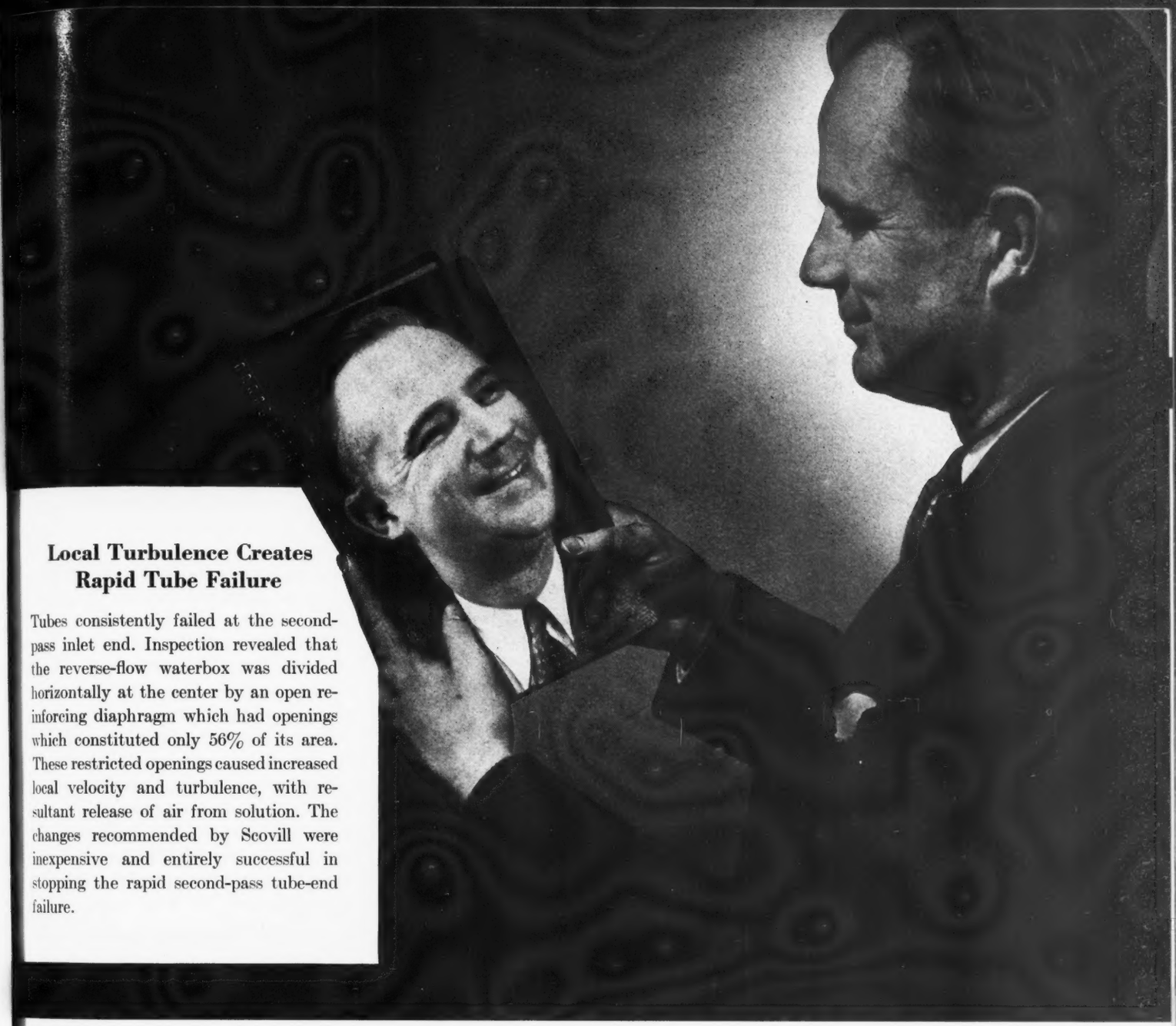
A heat exchanger could be substituted for the existing atmospheric cooling system. Plant water would be circulated through the raw-water side of the heater. This hookup would also help to cut down jacket scale deposits which can be extremely troublesome.

A combination of any of these could be used: (1)—water circulated through jackets and coil suspended in muffler, or water jacket around exhaust line; (2)—a combination of the muffler coil or exhaust-line water jacket and a heat exchanger. The water could be heated by a waste-heat boiler, or the present boiler might be changed over so as to operate as a heater with exhaust gases used as the heating medium.

The simplest of the above suggested methods involves the water being circulated through the water jackets. The piping hookup would consist of a supply line to the jacket manifold and a discharge line leading to the plant supply header. Provisions should be made for automatic relief of the water in the discharge line.

A heat exchanger in series with an exhaust-line water jacket would permit wide control of the discharge tempera-

(*Continued on page* 112)



Local Turbulence Creates Rapid Tube Failure

Tubes consistently failed at the second-pass inlet end. Inspection revealed that the reverse-flow waterbox was divided horizontally at the center by an open reinforcing diaphragm which had openings which constituted only 56% of its area. These restricted openings caused increased local velocity and turbulence, with resultant release of air from solution. The changes recommended by Scovill were inexpensive and entirely successful in stopping the rapid second-pass tube-end failure.

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 (Continued from page 110)

ture. The piping should be arranged so that the heat exchanger or the exhaust-line jacket could be bypassed.

The amount of water which may be heated is dependent upon the size of the intake and discharge headers, engine load, and the temperature rise required. Assuming that the peak demands for heated water do not coincide with peak loads on the engine, some form of a storage tank will be necessary.

The writer suggests that FWE consult Data Sheet No. 112, POWER, December, 1941, pg 126, and "Methods for Diesel Heat Recovery," POWER, October, 1940.

Bronx, N. Y. T G HICKS

Tank Size Depends on Engine Load

FWE SUPPLIES ONLY A LIMITED AMOUNT of data in his problem, so certain values must be assumed. It is entirely possible that maximum water demand will occur when the engine is carrying a minimum load of 150 hp. Using fuel oil with a heat value of 19000 Btu per lb we can assume that the engine will consume 0.5 lb per bhphr. Heat loss to the jacket water will be approximately 27% of fuel consumed.

Under these conditions heat supplied by the jacket is $150 \times 0.5 \times 19000 \times 0.27 = 385{,}000$ Btu per hour. Maximum heat required by the water is $1000 \times 8.33 \times 80$ F (temp rise) = 666,000 Btu per hour.

Minimum heat supplied on a 24-hr basis is $24 \times 385{,}000 = 9{,}250{,}000$ Btu. Maximum heat required on the basis of 8000 gal per day is $8000 \times 8.33 \times 80 = 5{,}330{,}000$ Btu. The minimum horsepower required to supply maximum hourly demand is

$$\frac{666{,}000}{0.5 \times 19000 \times 0.27} = 260 \text{ hp}$$

If minimum engine load and maximum water demand occur at the same time and for a period of as much as three hours, a 2000-gal storage tank should be used. If the engine load exceeds 260 hp at maximum water demand, a smaller storage tank could be used, as the engine would supply water as fast as it was used.

The overflow may be located at the bottom of the tank and operated by a motorized or thermostatically controlled valve so that the overflow will consist of the colder water. If the water required does not have to be pure, the overflow may be pumped to the present cooling tower and recirculated through the entire system. If pure water is required for plant use, the overflow may go to the sewer or a series of control valves may be installed so that the water through the cooling tower will be circulated only through the engine and cooling tower and not to the hot-water storage tank. These valves will provide that only city water flows through the engine when hot water is being added to the storage tank. A thermostat will regulate the temperature of the jacket water out of the engine.

Atlanta, Ga. A W REGER
J B BAKER

Heating Coil In Storage Tank

IN FWE'S PROBLEM on diesel waste heat, the exhaust gases could also be used in raising the water temperature. The outside temperature would serve as a guide in using the exhaust gases and the circulating water from the system.

The size of storage tank, while not given, should be approximately 2000 gal to supply adequate storage. The tank should contain a heating coil through which the engine cooling water can be circulated.

The water in the tank would absorb heat from the hot water in the coil coming from the engine jackets, and the cooling water could be supplied or throttled so as to raise the temperature on the discharge side of the engine. The warmer the water the easier the ignition within limits of temperature for cooling systems. Marine diesel engines are often run with water temperatures of 160 F.

Philadelphia, Pa. T F CUNNINGHAM

Cooling Water Inefficient

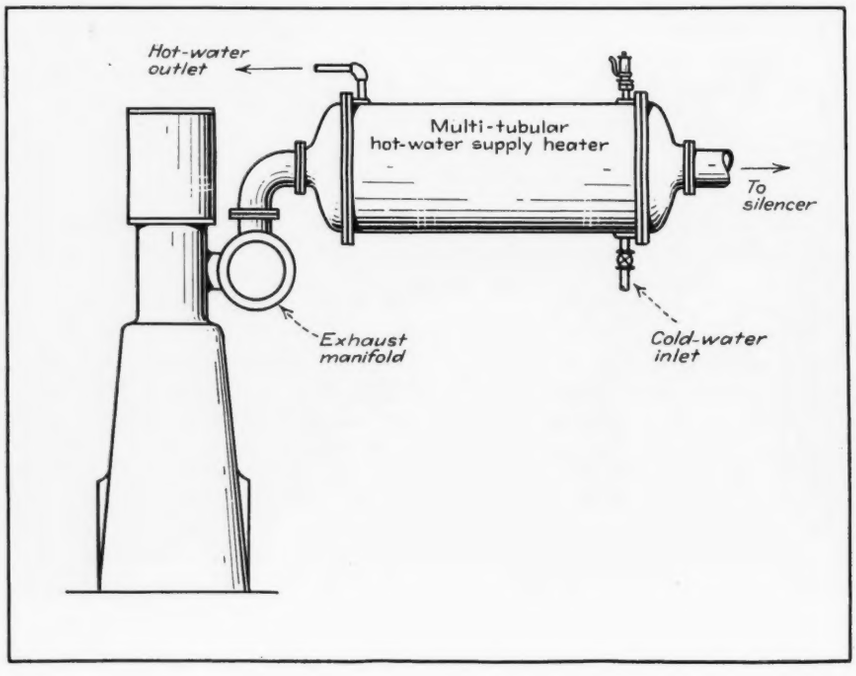
IT IS NOT ADVISABLE to utilize the cylinder jacket cooling water of a diesel engine for any purpose other than the cooling water's specific job, which is to maintain a desirable thermal efficiency of the diesel. There are cases where the fuel oil is heated by the jacket water; but in the case mentioned, where the hot-water consumption reaches 1000 gallons per hour, it is impractical.

If a separate boiler is used for heating the water, the diesel-engine exhaust can be used as heat source, if the boiler is a multi-tubular vertical unit.

There are diesel plants operating on various fuels from sewage gas to heavy crudes which utilize the exhaust gases to heat the hot water supply systems, and there are numerous hot water heaters on the market.

FWE states that the water from the diesel engine jacket is cooled by an atmospheric cooling tower. To dispense with this system and utilize the jacket water to heat the building hot-water supply would mean the installation of a water heater, and this would change the system to a closed circuit. The thermal losses in heat transfer from the jacket cooling water to the heater would be detrimental to the efficiency of the engine.

Grand Rapids, Mich. J M GORRIE



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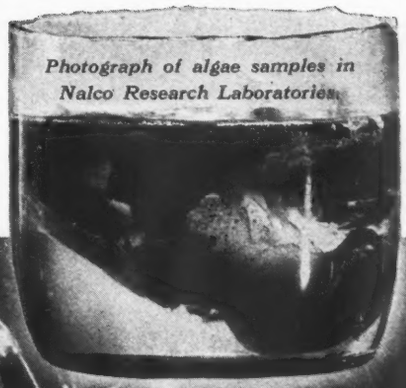

Photograph of algae samples in Nalco Research Laboratories

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ARGUMENT CORNER

Here's Why You Can't Have Tin

(The author—a noted authority, who asks us to withhold his name—shows how, with the "help" of the Japs, the U. S. tin situation became acute. If you think you need tin for babbitt bearings, and want to know what to do about it, see the symposium on page 74, also Wartime Power Clinic, page 91.)

The strategic importance of tin has been brought forcibly to the front as a result of the war with Japan and her steady advance in the Southwest Pacific. The principal tin-producing countries at this writing are already lost to the United Nations as sources of this important raw material.

Since there are no known significant deposits of tin ore on the North American continent, our government entered into an agreement in July, 1940 with the International Tin Committee to purchase all surplus tin offered, up to 75,000 tons per year at not less than 50¢ per pound, for a period of one year.

In 1941 this agreement was extended until July 1942. In addition, The Metals Reserve Company contracted with several Bolivian producers to purchase tin concentrates containing 18,000 tons of metallic tin per year over a 5-year period. Arrangements were eventually consummated for the construction and operation of a tin smelter at Texas City having an annual capacity adequate to smelt this amount of ore. It is anticipated that processing of tin ore at the Texas City smelter will start early in the second quarter of this year.

Simultaneous with the government program of stock piling, private industry began building up inventories which proceeded at a rapid rate under the stabilizing influence of the agreement until hostilities broke out. In view of the complete cutoff of importation of Straits tin to this country, the present supply of tin, together with that obtained from the Texas City smelter and from the detinning processes on tinplate scrap, must last for the duration of the war plus an additional period for rehabilitation after a United Nation victory. It has, therefore, become mandatory to conserve tin wherever possible both at home and in industry.

The two largest single uses of tin in this country are for tin plate and solder, hence first attention has been given these applications. As a result the use of tin plate in the canning industry has been drastically cut despite the increased demands upon the industry to preserve the maximum amount of food for the armed forces, lend-lease and civilian consumption. A program of converting the tinplate industry from conventional hot dipping process to electrolytic tinning, under way since 1937, has been given fresh impetus. This program will eventually save more than 50% of the tin consumed for this purpose. Appreciable savings in tin for solder manufacture are being effected by eliminating certain applications and reducing the percentage of tin for all solder. Commercial trials are under way using a tinless solder consisting of 2.5 to 5.0% silver, balance lead.

Coincident with this program, additional savings in tin have been effected by reducing the tin content of collapsible tubes, foil, type metal, piping and tubes and for the tin for hot-dipped galvanizing where tin was used to control the appearance and spangle. The power field will be affected by the tin conservation program as it affects bronze, tin-base and lead-base bearing metals.

The cooperation of every user of tin metal or tin alloys is essential if our stocks of this metal are to cover the essential uses during the coming several years of concentrated production effort.

Too Close to Our Work?

SOMETIMES WE ARE SO CLOSE to our work that we do not see the effects of what we do. I think this was the case in the experience related by C P Fisher, Jr, in his short article, April number, on page 104. Before the capacitor was installed the engine and generator speed was increased 10% in an attempt to get a workable voltage at the load. This would have been all right on a direct-current machine, when dealing with voltage only. However, on an alternating-current generator both voltage and frequency are increased the same percentage. As a result you are probably worse off than before increasing the generator speed.

Increasing the voltage and frequency 10% on a contactor coil will not have any effect. A 10% increase in voltage alone would increase the current in the coil 10%, but a 10% increase in frequency would decrease the current 10% so that the combined effect of the two is zero.

Other conditions being equal, a 10% increase in voltage and frequency on an induction motor should result in an increase in torque and a decrease in current, but the motor speed will be increased 10%. If we assume constant torque loads driven by the motors the load will increase directly as the speed and the result should be zero insofar as improving the voltage on the system.

Many loads, however, such as centrifugal pumps and certain types of fans, increase as the square or the cube of the speed. A 10% increase in centrifugal-pump speed will require a 33% increase in power input. If any appreciable amount of the dredge load is pumps, then speeding up the generators must have caused a considerable load increase. In any event, voltage conditions must have been made worse by speeding up the generators and not improved, as apparently believed by the operators.

This is why the capacitor was so successful in correcting the bad voltage conditions. First the generators were operated at normal speed, which eliminated the bad effects of overspeeding them. These may have been considerable. Adding the benefits obtained from installing the capacitor to those realized from operating the plant under normal conditions and the results stack up to an almost astonishing improvement. This is another example of what can be accomplished by installation of capacitors to improve power factor.

Incidentally if the generators had been slowed down about 5% instead of increasing their speed 10% it probably would have improved conditions. The load would have been reduced and the combined effect of other changes would have improved voltage regulation.

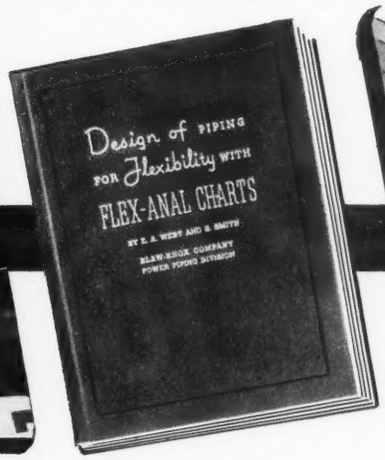
Chicago, Ill. J B MULLINS

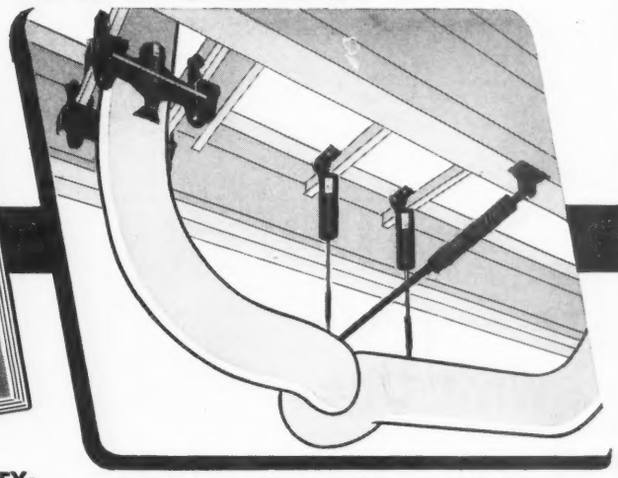
Boosts Sketching

YOUR ARTICLE, "How to Sketch," page 101 of November POWER, interests me very much. I have often discussed the inability of the average technical graduate to make a perspective sketch which anyone who could interpret a picture could understand.

(*Continued on page* 120)

POWER PIPING DIVISION recommends this scientific approach to your PIPING PROBLEMS





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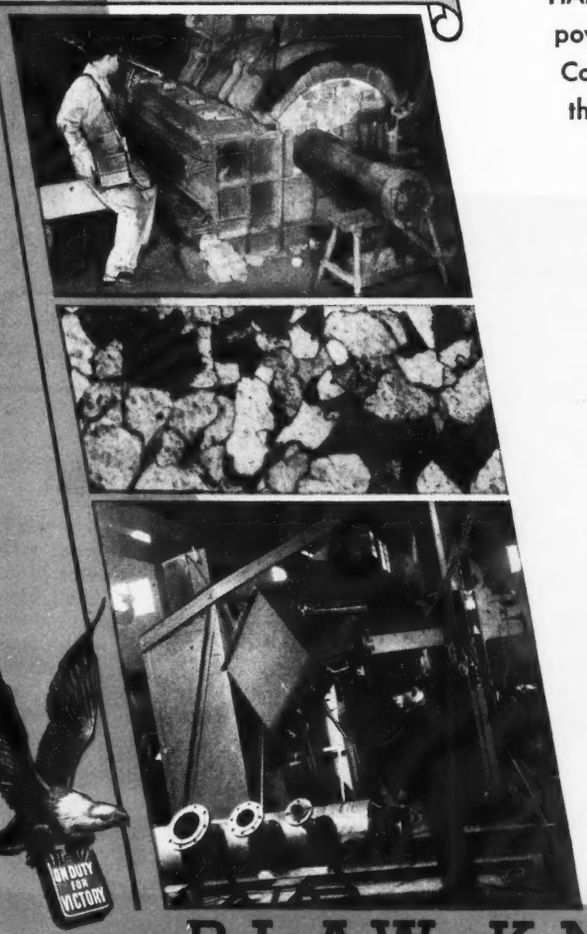
SOME CONTROL PROCEDURES INSTITUTED BY POWER PIPING DIVISION



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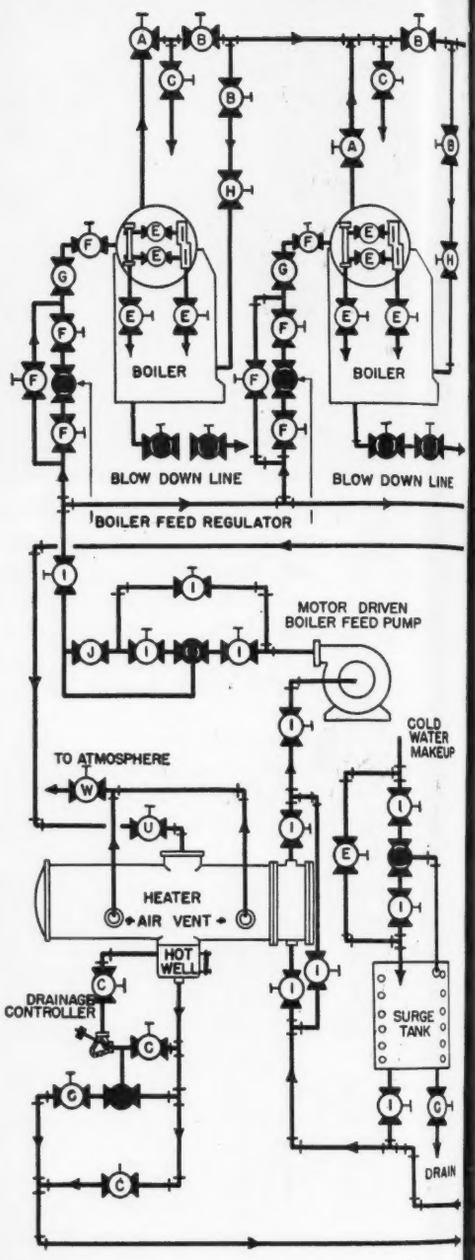

This diagram shows a typical turbine-equipped condensing power plant with closed heater connections and one stage of bleed for heating. In a condensing power plant, the greatest loss of useful steam-capacity is generally due to the amount of heat diverted to raise the temperature of the condenser cooling-water. This loss is minimized by bleeding steam from the prime mover to a closed heater. Over-all economy is promoted, since practically all the heat in the bled steam is recovered by the use of a closed heater. This type is able to take steam at pressures above atmospheric, thus permitting the heating of feed water to temperatures higher than the 215°F. limit of open heaters. All the auxiliaries in this hookup are electrically driven, since there is no economy in using exhaust steam in this type of installation.

Wherever you expect good valve design to result in good economical service, specify Jenkins Valves. They give longer life, fewer interruptions due to maintenance, and you pay no premium for them.

TYPICAL JENKINS VALVES USED IN THIS HOOK-UP

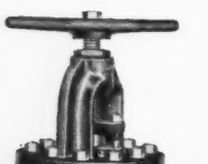

Fig. 293 IBBM Non-Return Automatic Equalizing Stop and Check

Fig. 142 IBBM Globe Renewable Composition Disc

Fig. 295 IBBM Swing Check Renewable Composition Disc

Fig. 962 Bronze Swing Check Regrinding Bronze Disc

Fig. 976 Bronze Globe Stainless Steel Plug and Seat

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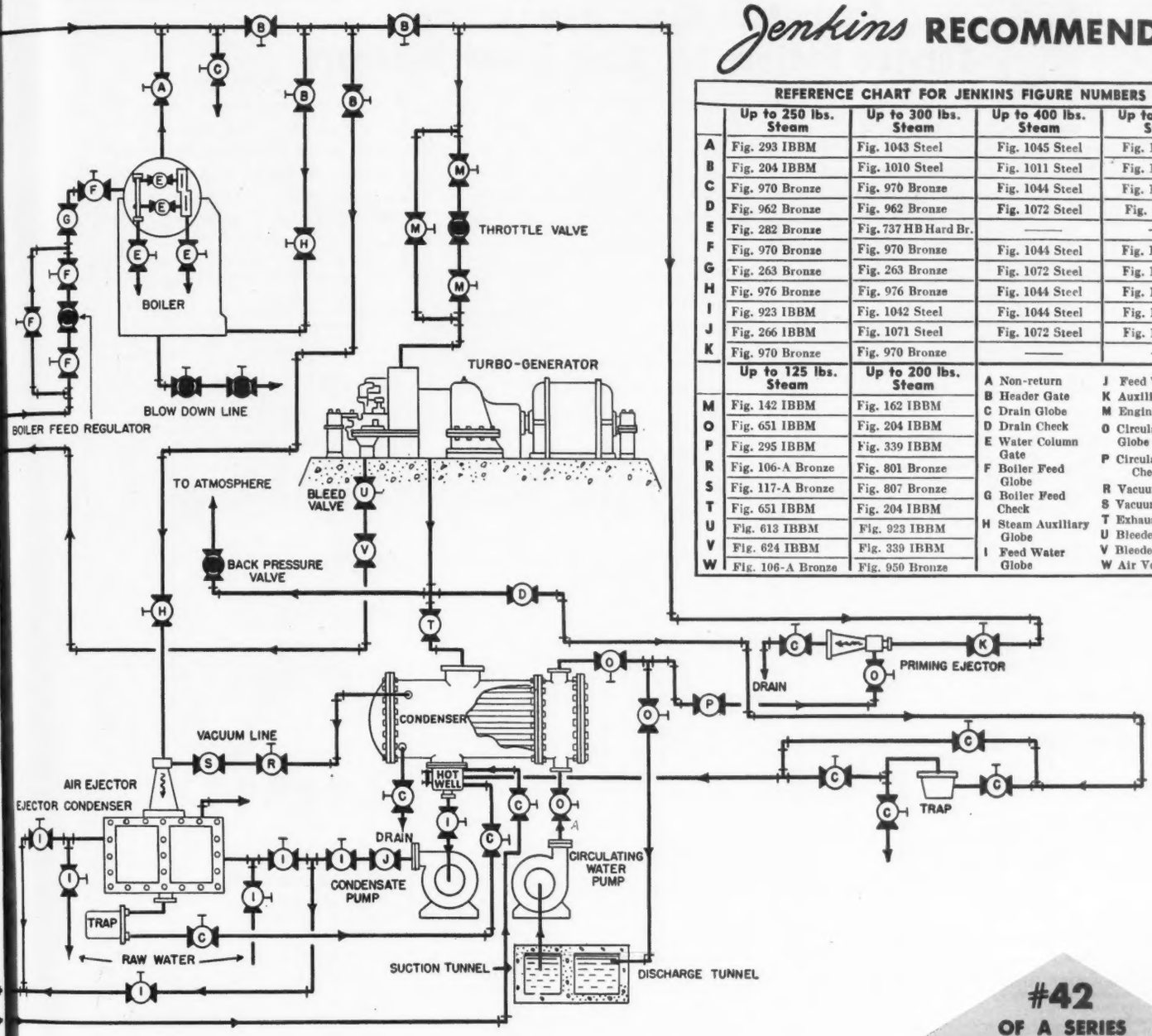

Jenkins RECOMMENDS...

REFERENCE CHART FOR JENKINS FIGURE NUMBERS

	Up to 250 lbs. Steam	Up to 300 lbs. Steam	Up to 400 lbs. Steam	Up to 600 lbs. Steam
A	Fig. 293 IBBM	Fig. 1043 Steel	Fig. 1045 Steel	Fig. 1047 Steel
B	Fig. 204 IBBM	Fig. 1010 Steel	Fig. 1011 Steel	Fig. 1012 Steel
C	Fig. 970 Bronze	Fig. 970 Bronze	Fig. 1044 Steel	Fig. 1046 Steel
D	Fig. 962 Bronze	Fig. 962 Bronze	Fig. 1072 Steel	Fig. 1073 Steel
E	Fig. 282 Bronze	Fig. 737 HB Hard Br.	——	——
F	Fig. 970 Bronze	Fig. 970 Bronze	Fig. 1044 Steel	Fig. 1046 Steel
G	Fig. 263 Bronze	Fig. 263 Bronze	Fig. 1072 Steel	Fig. 1073 Steel
H	Fig. 976 Bronze	Fig. 976 Bronze	Fig. 1044 Steel	Fig. 1046 Steel
I	Fig. 923 IBBM	Fig. 1042 Steel	Fig. 1044 Steel	Fig. 1046 Steel
J	Fig. 266 IBBM	Fig. 1071 Steel	Fig. 1072 Steel	Fig. 1073 Steel
K	Fig. 970 Bronze	Fig. 970 Bronze	——	——
	Up to 125 lbs. Steam	**Up to 200 lbs. Steam**		
M	Fig. 142 IBBM	Fig. 162 IBBM		
O	Fig. 651 IBBM	Fig. 204 IBBM		
P	Fig. 295 IBBM	Fig. 339 IBBM		
R	Fig. 106-A Bronze	Fig. 801 Bronze		
S	Fig. 117-A Bronze	Fig. 807 Bronze		
T	Fig. 651 IBBM	Fig. 204 IBBM		
U	Fig. 613 IBBM	Fig. 923 IBBM		
V	Fig. 624 IBBM	Fig. 339 IBBM		
W	Fig. 106-A Bronze	Fig. 950 Bronze		

A Non-return
B Header Gate
C Drain Globe
D Drain Check
E Water Column Gate
F Boiler Feed Globe
G Boiler Feed Check
H Steam Auxiliary Globe
I Feed Water Globe
J Feed Water Check
K Auxiliary Globe
M Engine Globe
O Circulating Water Globe
P Circulating Water Check
R Vacuum Globe
S Vacuum Check
T Exhaust Gate
U Bleeder Globe
V Bleeder Check
W Air Vent Globe

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Number 117

Gearmotor Class Numbers and Service Factors for Gear Speed Reducers

(Except Worm Gears)

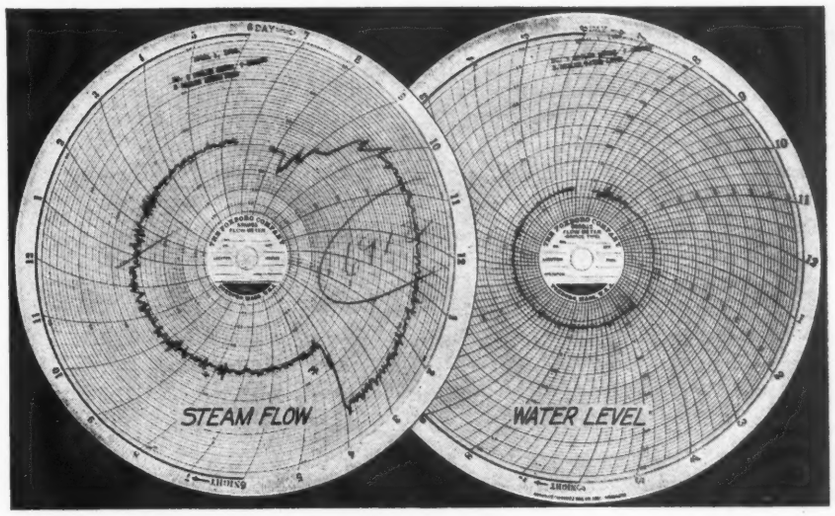
▶ To select horsepower rating of a gear speed reducer, multiply horsepower required to drive the load, or power-unit horsepower, by the proper service factor. For example, assume a lobe-type blower to be motor driven 8 to 10 hr per day, requiring 45 hp to drive it. Service factor for this condition is 1.25. Select gear reducer for not less than $45 \times 1.25 = 56.25$ hp. If power to drive load is not accurately known use power-unit horsepower. If a gearmotor is to be used, select a 50-hp, class 2 unit for this application. *Courtesy of Philadelphia Gear Works.*

Drive	Electric motor				Multi-cylinder internal-combustion engine				Single-cylinder internal-combustion engine				Gearmotor	
Operation, hours per day	0.5	3	8–10	24	0.5	3	8–10	24	0.5	3	8–10	24	8–10	24
APPLICATIONS		Service	Factor			Service	Factor			Service	Factor		Class No.	
Agitators														
Pure liquid	0.5	0.8	1.0	1.25	0.8	1.0	1.25	1.5	1.0	1.25	1.5	1.75	1	2
Variable liquid	0.5	0.8	1.0	1.25	0.8	1.0	1.25	1.5	1.0	1.25	1.5	1.75	2	2
Blowers														
Centrifugal	0.5	0.8	1.0	1.25	0.8	1.0	1.25	1.5	1.0	1.25	1.5	1.75	1	2
Lobe	0.8	1.0	1.25	1.5	1.0	1.25	1.5	1.75	1.25	1.5	1.75	2.0	2	2
Brewing and distilling equipment														
Bottling machinery	0.5	0.8	1.0	1.25	0.8	1.0	1.25	1.5	1.0	1.25	1.5	1.75	1	2
Kettles, cookers, mash tubs, scale hopper	0.5	0.8	1.0	1.25	0.8	1.0	1.25	1.5	1.0	1.25	1.5	1.75	2	2
Car dumpers	1.25	1.5	1.75	2.0	1.5	1.75	2.0	2.25	1.75	2.0	2.25	2.5	2	3
Car pullers	0.8	1.0	1.25	1.5	1.0	1.25	1.5	1.75	1.25	1.5	1.75	2.0	2	3
Clarifiers	0.5	0.8	1.0	1.25	0.8	1.0	1.25	1.5	1.0	1.25	1.5	1.75	1	2
Classifiers	0.8	1.0	1.25	1.5	1.0	1.25	1.5	1.75	1.25	1.5	1.75	2	2	2
Clay-working machinery														
Brick presses, briquett machines	1.25	1.5	1.75	2.0	1.5	1.75	2.0	2.25	1.75	2.0	2.25	2.5	3	3
Clay-working machines, pug mills	0.8	1.0	1.25	1.5	1.0	1.25	1.5	1.75	1.25	1.5	1.75	2	2	2
Compressors														
Centrifugal	0.5	0.8	1.0	1.25	0.8	1.0	1.25	1.5	1.0	1.25	1.5	1.75	1	2
Rotary	0.5	0.8	1.0	1.25	0.8	1.0	1.25	1.5	1.0	1.25	1.5	1.75	2	2
Reciprocating, 3 or more cylinders	0.8	1.0	1.25	1.5	1.0	1.25	1.5	1.75	1.25	1.5	1.75	2.0	2	3
Reciprocating, 1 or 2 cylinders	1.25	1.5	1.75	2.0	1.5	1.75	2.0	2.25	1.75	2.0	2.25	2.5	*	*
Conveyors, uniformly loaded or fed														
Apron, assembly, belt, flight, oven, screw	0.5	0.8	1.0	1.25	0.8	1.0	1.25	1.5	1.0	1.25	1.5	1.75	1	2
Conveyors, heavy duty														
Apron, assembly, belt, flight, oven, screw	0.8	1.0	1.25	1.5	1.0	1.25	1.5	1.75	1.25	1.5	1.75	2	2	2
Reciprocating or shaker	1.25	1.5	1.75	2.0	1.5	1.75	2.0	2.25	1.75	2.0	2.25	2.5	3	3
Cranes and hoists														
Main hoist, medium duty	....	....	....	....	....	....	....	....	....	....	....	....	2	2
Main hoist, heavy duty	....	....	....	....	....	....	....	....	....	....	....	....	3	3
Travel motion, trolley motion	0.8	1.0	1.25	1.5	1.0	1.25	1.5	1.75	1.25	1.5	1.75	2	2	2
Skip hoist	0.8	1.0	1.25	1.5	1.0	1.25	1.5	1.75	1.25	1.5	1.75	2.0	2	2
Crushers														
Ore, stone	1.25	1.5	1.75	2.0	1.5	1.75	2.0	2.25	1.75	2.0	2.25	2.5	....	.....
Draw benches	0.8	1.0	1.25	1.5	1.0	1.25	1.5	1.75	1.25	1.5	1.75	2.0	....	.....
Dredges														
Cable reels, conveyors, pumps, stackers, winches	0.8	1.0	1.25	1.5	1.0	1.25	1.5	1.75	1.25	1.5	1.75	2.0	2	2
Cutter heads, jigs, screens	1.25	1.5	1.75	2.0	1.5	1.75	2.0	2.25	1.75	2.0	2.25	2.5	3	3
Elevators														
Bucket, uniformly fed	0.5	0.8	1.0	1.25	0.8	1.0	1.25	1.5	1.0	1.25	1.5	1.75	2	2
Bucket (heavy-duty), passenger	0.8	1.0	1.25	1.5	1.0	1.25	1.5	1.75	1.25	1.75	2.0	2.25	3	3
Freight	0.8	1.0	1.25	1.5	1.0	1.25	1.5	1.75	1.25	1.75	2.0	2.25	2	2
Fans														
Light, centrifugal, propeller	0.5	0.8	1.0	1.25	0.8	1.0	1.25	1.5	1.0	1.25	1.5	1.75	1	2
Cooling tower, large mine	0.8	1.0	1.25	1.5	1.0	1.25	1.5	1.75	1.25	1.5	1.75	2	2	3
Food machinery														
Beet slicers, dough mixers, meat grinders	0.8	1.0	1.25	1.5	1.0	1.25	1.5	1.75	1.25	1.5	1.75	2	2	2
Cereal cookers	0.5	0.8	1.0	1.25	0.8	1.0	1.25	1.5	1.0	1.25	1.5	1.75	1	2
Generators	0.5	0.8	1.0	1.25	0.8	1.0	1.25	1.5	1.0	1.25	1.5	1.75	....	.....
Hoists (see cranes)														
Kilns, cement, lime, rotary	0.8	1.0	1.25	1.5	1.0	1.25	1.5	1.75	1.25	1.5	1.75	2.0	....	.....
Laundry tumblers	0.8	1.0	1.25	1.5	1.0	1.25	1.5	1.75	1.25	1.5	1.75	2.0	2	2
Washers	0.5	0.8	1.0	1.25	0.8	1.0	1.25	1.5	1.0	1.25	1.5	1.75	2	2
Lineshafts, light	0.5	0.8	1.0	1.25	0.8	1.0	1.25	1.5	1.0	1.25	1.5	1.75	1	2
Mills, rotary														
Ball, pebble	0.8	1.0	1.25	1.5	1.0	1.25	1.5	1.75	1.25	1.5	1.75	2	3	3
Hammer, rod	1.25	1.5	1.75	2.0	1.5	1.75	2.0	2.25	1.75	2.0	2.25	2.5	3	3
Mixers														
Concrete	0.8	1.0	1.25	1.5	1.0	1.25	1.5	1.75	1.25	1.5	1.75	2.0	2	2
Liquid and semi-liquid	0.5	0.8	1.0	1.25	0.8	1.0	1.25	1.5	1.0	1.25	1.5	1.75	2	2
Oil-well pumps	....	....	....	....	....	....	....	....	....	....	....	....	3	3
Oil-refinery equipment														
Chillers, paraffin-filter presses, rotary kilns	0.8	1.0	1.25	1.5	1.0	1.25	1.5	1.75	1.25	1.5	1.75	2.0	2	2
Paper-mill equipment														
Agitators, bleachers, cylinders, felt stretchers	0.8	1.0	1.25	1.5	1.0	1.25	1.5	1.75	1.25	1.5	1.75	2.0	2	2
Barkers, beaters, calenders, couches, jordans	0.8	1.0	1.25	1.5	1.0	1.25	1.5	1.75	1.25	1.5	1.75	2.0	3	3
Presses, suction rolls, stock chests	0.5	0.8	1.0	1.25	0.8	1.0	1.25	1.5	1.0	1.25	1.5	1.75	3	3
Pumps														
Centrifugal, rotary	0.5	0.8	1.0	1.25	0.8	1.0	1.25	1.5	1.0	1.25	1.5	1.75	1	2
Proportioning	0.8	1.0	1.25	1.5	1.0	1.25	1.5	1.75	1.25	1.5	1.75	2.0	2	3
Reciprocating, multi-cylinder	0.8	1.0	1.25	1.5	1.0	1.25	1.5	1.75	1.25	1.5	1.75	2.0	2	2
Reciprocating, single cylinder	1.25	1.5	1.75	2.0	1.5	1.75	2.0	2.25	1.75	2.0	2.25	2.5	*	*
Rubber-mill equipment														
Mixers, sheeters, mills	1.25	1.5	1.75	2.0	1.5	1.75	2.0	2.25	1.75	2.0	2.25	2.5	3	3
Calenders	0.8	1.0	1.25	1.5	1.0	1.25	1.5	1.75	1.25	1.5	1.75	2.0	2	3
Tubers, tire-building machines	0.8	1.0	1.25	1.5	1.0	1.25	1.5	1.75	1.25	1.5	1.75	2.0	2	2
Screens														
Air washing, water, traveling	0.5	0.8	1.0	1.25	0.8	1.0	1.25	1.5	1.0	1.25	1.5	1.75	1	1
Rotary, gravel or stone	0.8	1.0	1.25	1.5	1.0	1.25	1.5	1.75	1.25	1.5	1.75	2.5	2	2
Stokers	0.5	0.8	1.0	1.25	0.8	1.0	1.25	1.5	1.0	1.25	1.5	1.75	2	2
Textile machinery														
Batchers, calenders, cards, dry cans	0.5	0.8	1.0	1.25	0.8	1.0	1.25	1.5	1.0	1.25	1.5	1.75	2	2
Looms	0.8	1.0	1.25	1.5	1.0	1.25	1.5	1.75	1.25	1.5	1.75	2.0	*	*

* *Consult the manufacturer.*

600 POUNDS W. S. P.

Firing with acid sludge or gas normal evaporation is as high as 350,000 lb. per hr. on this 600-lb. pressure Riley Steam Generator. Water level is carried one inch higher at 360,000 lb. per hr. peak load than at normal minimum of 242,000 lb. per hr. Level control by COPES Flowmatic is unusually close on all loads.



★ *Unaffected by drafts or changes in temperature—even outdoors*

CENSORED

We can't tell you the name of this company or the location of its plants—not until the war is won—because it is in the vanguard of those producing for victory. But we can show you, by repeat orders, how this company depends on COPES Flowmatic for close boiler water level control, in spite of rapidly changing loads.

The first two Flowmatics were installed on a 600-pound Riley unit, capacity 350,000 pounds an hour, in 1937. Since then, six repeat orders have been placed by this important user:

Date	No.	Boiler	WSP Lb.	Cap. Lb./Hr.
1940	1*	Riley	620	350,000
1941	4	C-E	175	140,000
	1	Kellogg	390	72,000
	1*	C-E	620	300,000
1942	1	C-E	620	300,000
	1	Riley	400	60,000

*Two COPES Flowmatic Regulators installed on each boiler.

EXPERIENCE shows that changes in atmospheric temperature have no effect on the dependably accurate performance of the COPES Flowmatic Regulator. This installation, for example, is all outdoors and temperature changes of 80 degrees F. have not interfered with correct feed regulation or water level control. Nor has there been need for factory service. This Flowmatic, cut into service and accurately adjusted by plant personnel, has worked well for more than four years with only routine inspection and care. Write for Bulletin 429 describing the simplified two-element steam-flow type COPES Flowmatic Regulator.

NORTHERN EQUIPMENT CO., 521 GROVE DRIVE, ERIE, PA.

Feed Water Regulators, Pump Governors, Differential Valves
Liquid Level Controls, Reducing Valves and Desuperheaters

BRANCH PLANTS IN CANADA, ENGLAND REPRESENTATIVES EVERYWHERE

★ GET CLOSER LEVEL CONTROL WITH THE COPES FLOWMATIC ★ REGULATOR

Continued from page 114

Your article recommends the greater use of the isometric, which pretty largely meets my own ideas. Many and many a time I have seen a project get off to a bad start merely because the leader didn't get his ideas to his followers in a clear way, for lack of mutually understood expressions, idioms and punctuations. A simple sketch would have clarified the whole situation.

I sincerely hope you will continually harp on this interesting and important theme, pushing the idea into the technical schools more and more.

New York, N. Y. GEO R WADLEIGH
Manager, Engineering Dept
West Virginia Pulp and Paper Co

How to Measure Distances Between Bolt Centers

AFTER READING S M ELONKA'S ARTICLE, "How to Measure Distance Between Bolt Centers," in February POWER, I want to defend the "center-to-center man." When I was attending school one of my instructors had a favorite expression about "using a micrometer on the end of a hemp rope." I think the expression applies in this instance. Striving for extreme accuracy may reach the point of being wasted effort, particularly for conditions like Fig. 1.

Assuming that Mr Elonka is trying to locate the bolt-hole centers accurately and thus establish the bolt circle, regardless of how carefully measurements are taken from center-to-center or side-to-side of the bolt, it is practically certain that errors exist. Flange-bolts do not usually fit snugly in their holes, it being customary to drill the holes at least ⅛ in. larger than the bolt diameter. This allows the bolts to be eccentric with their holes.

In addition, although flanges are usually machined to fairly close tolerances by the manufacturer, the bolt-holes may be drilled by the jobber's janitor or some other semi-competent person. Or, they may be drilled in a plant where no facilities are available for accurate work in laying out, setting up, or drilling. If a bolt can be driven through the corresponding holes in companion flanges, it is considered satisfactory. Thus, if in measuring between several pairs of bolts, either way, several circles are obtained, which one is to be used?

Secondly, the measurements obtained by Mr Elonka's method are at least as questionable as those obtained by measuring center-to-center because of tilting the rule, Fig. 2. If the rule is laid alongside the bolts, Fig. 3, the visual angle or perspective will cause a distorted reading. Try measuring the diameter of a bar, bolt, or pipe by holding a rule up against them.

If a fair degree of accuracy is desired an average should be taken of the distances center-to-center or side-to-side (I'm a "center-to-center man" myself) of a number of bolts in a given flange. The center holes in machined bolts or studs are convenient for measuring purposes. For riveted seams it is usually the practice to obtain the pitch by measuring along a good portion of the seam, as in Fig. 4, and dividing the measurement by the number of included rivets. In Fig. 4 assume that the five center distances between the rivets total 6.25 in. Then, the average center distance is $6.25 \div 5 = 1.25$ in.

Melrose, Mass. E MACDERMOD

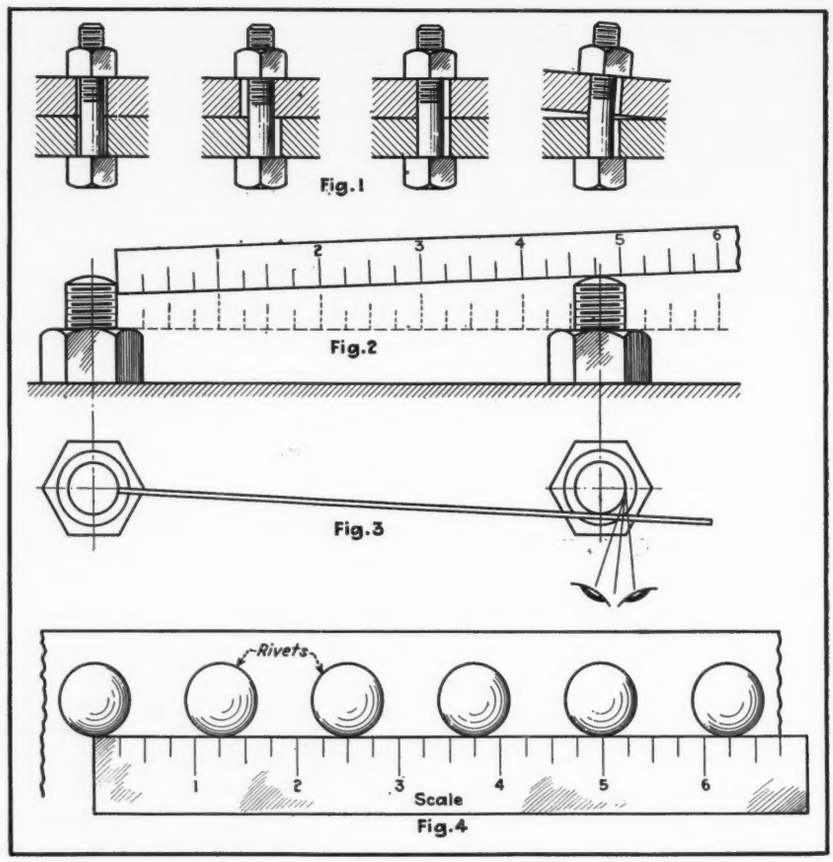
More About Welding in Upper Boiler Head

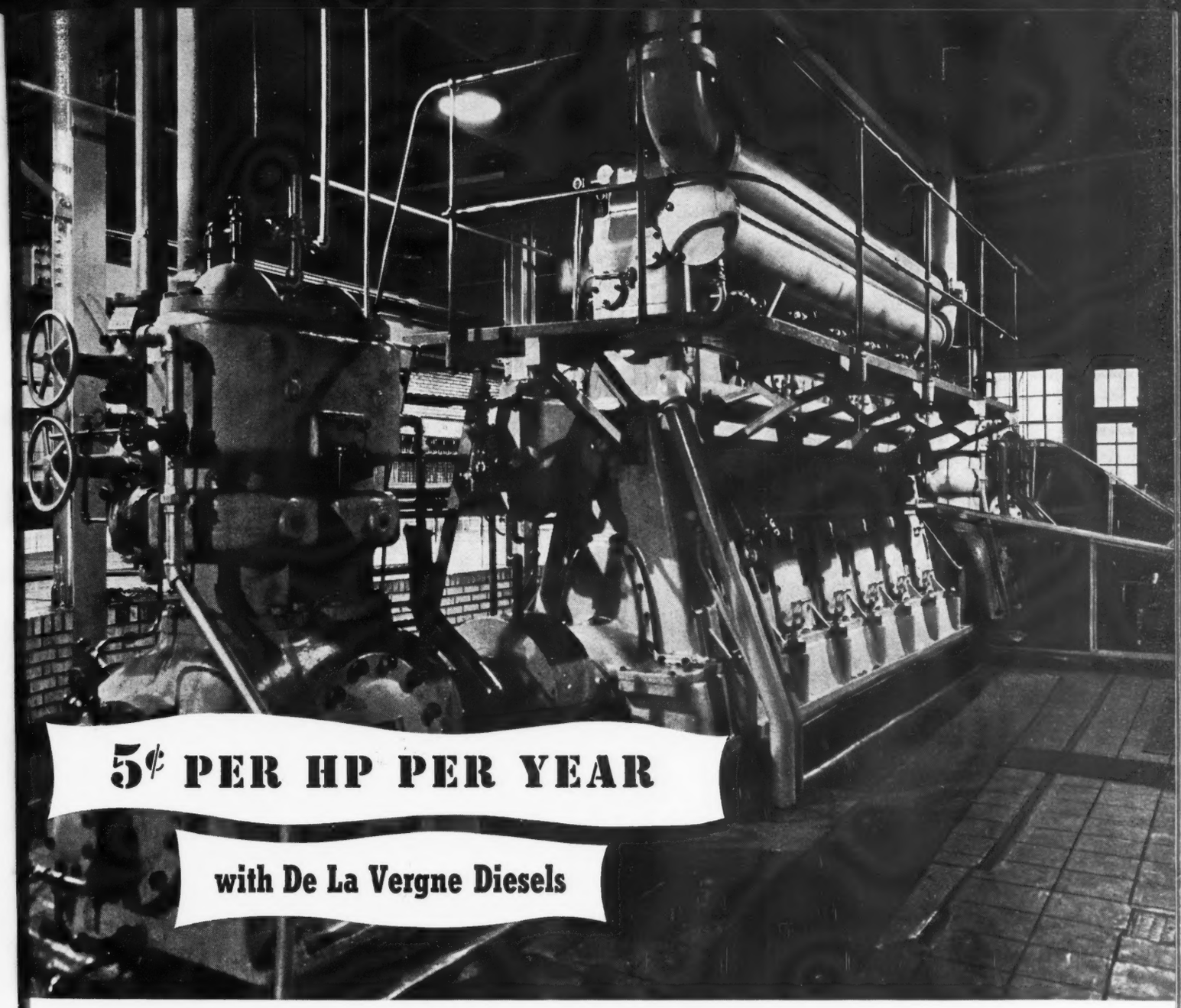
IN JANUARY POWER, Elton Sterrett takes some exceptions to the practices recommended in the article "Upper Head Welded in Vertical Tubular Boiler," published in the November number. He is quite correct in saying that welding on replacement heads of heat exchangers may be completed before the tubes are installed, so that the root of the weld may be examined by a mirror placed through the tube holes. However, in a vertical tubular boiler, the diameter is usually considerably greater than that of heat exchangers. Boiler diameters may be as great as 78 in., and in a few cases even larger.

Let us assume a fixed lower head with its tube hole layout. We install a new section of upper head with its tube layout lined up with the lower head. Perhaps by the step-back method of welding the creep of the upper head, caused by expansion, may not be appreciable. But, in rules laid down for field work, the upper head may rotate an appreciable amount due to the expansion accompanying the welding process. This is one reason why the tubes should be installed before the welding is completed. While I said that the tubes should be installed, expanding and beading of the tubes may be deferred until after welding on the new head has been completed.

I do not entirely agree with Mr Sterrett that if the upper head is so badly damaged as to demand replacement, the chances are that there will be

(*Continued on page* 130)





5¢ PER HP PER YEAR

with De La Vergne Diesels

For low maintenance costs, it's hard to beat the 5c-per-hp-per-year record of the two 320-hp De La Vergne diesels in the Huntington and Smithtown plants of the Long Island Ice Corporation. For a 10-year period, the entire cost for maintenance was $337.33—$164.01 at Huntington, $173.32 at Smithtown. Original pistons, cylinder liners, bearings, and inlet and exhaust valves are still in service.

Every item of operating cost has been low and not once in 75,000 hours of service in each plant have the diesels failed to deliver the required power.

The success of one plant might be a happy accident, but almost identical results at Huntington and Smithtown plants are evidence that the equipment and the operating system are right.

Careful planning, sound plant operation, and the best in diesels have produced two outstanding cases of diesel engine economy and durability.

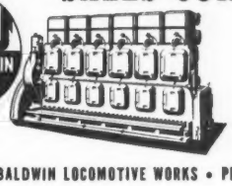
Regardless of your power requirements, there is a De La Vergne Diesel to suit your needs. Ranging in size from 200 bhp to 1500 bhp, these sturdy, precision-built engines are providing low-cost power in hundreds of plants from coast to coast. A De La Vergne engineer will be glad to assist you with your power problems.

BALDWIN

De La Vergne

SALES CORP.

BLW THE BALDWIN GROUP



SUBSIDIARY OF THE BALDWIN LOCOMOTIVE WORKS • PHILADELPHIA

BUILDERS OF DEPENDABLE ENGINES SINCE 1880

POWER LINES

Diesel Engineers to Discuss Wartime Problems at National Meeting in Peoria, June 17-19

A round-table session devoted to the practical problems of operation and maintenance under wartime conditions will keynote the 15th National Meeting and Exhibit of the Oil and Gas Power Division, ASME, to be held June 17–19 at the Hotel Pere Marquette, Peoria, Ill. Under the leadership of outstanding diesel engineers, municipal and industrial-plant operators will thrash out the problems arising from wartime limitations on equipment and repair parts and from the shortage of skilled men. Operators everywhere are invited to bring their questions to this highly practical and timely session.

Tentative Program

The tentative technical program includes: "Design of Internal-Combustion-Engine Power Plants" by G C Boyer, Burns & McDonnell Engrg Co; "Power Pulsations Between Synchronous Generators" by Troels Warming, Nordberg Mfg Co; "Excess Air and BMEP" by P H Schweitzer, Pennsylvania State College; "Design of Sleeve Bearings" by A B Willi, Federal-Mogul Corp; "A New Two-Cycle Engine" by H M Jacklin, Purdue University; "Heat Recovery Possibilities of Diesel Engines" by F P Grutzner, Fairbanks, Morse & Co; "Pipeline Pumping Stations" by Charles Keane, Great Lakes Pipeline Co; "Factors Influencing Distribution of Loads in Bolted Joints" by T J Dolan, University of Illinois; "Developments in Closed Cooling Systems" by J W Bostwick, Fairbanks, Morse & Co.

Largest Exhibit

The exhibit will be the largest ever held and close to 30 leading manufacturers have arranged to display the latest in engines and accessory equipment. A new feature will be the Scientific Exhibit which will include displays of research apparatus and developments from universities and research organizations. Considerable interest attaches to the exhibition of a captured Mercedes-Benz aircraft engine, the details of which will be described in a talk by Raymond W Young, chief engr, Wright Aeronautical Corp.

If wartime restrictions permit, several interesting inspection trips will be arranged and the local committee is planning an attractive social program highlighted by the annual banquet.

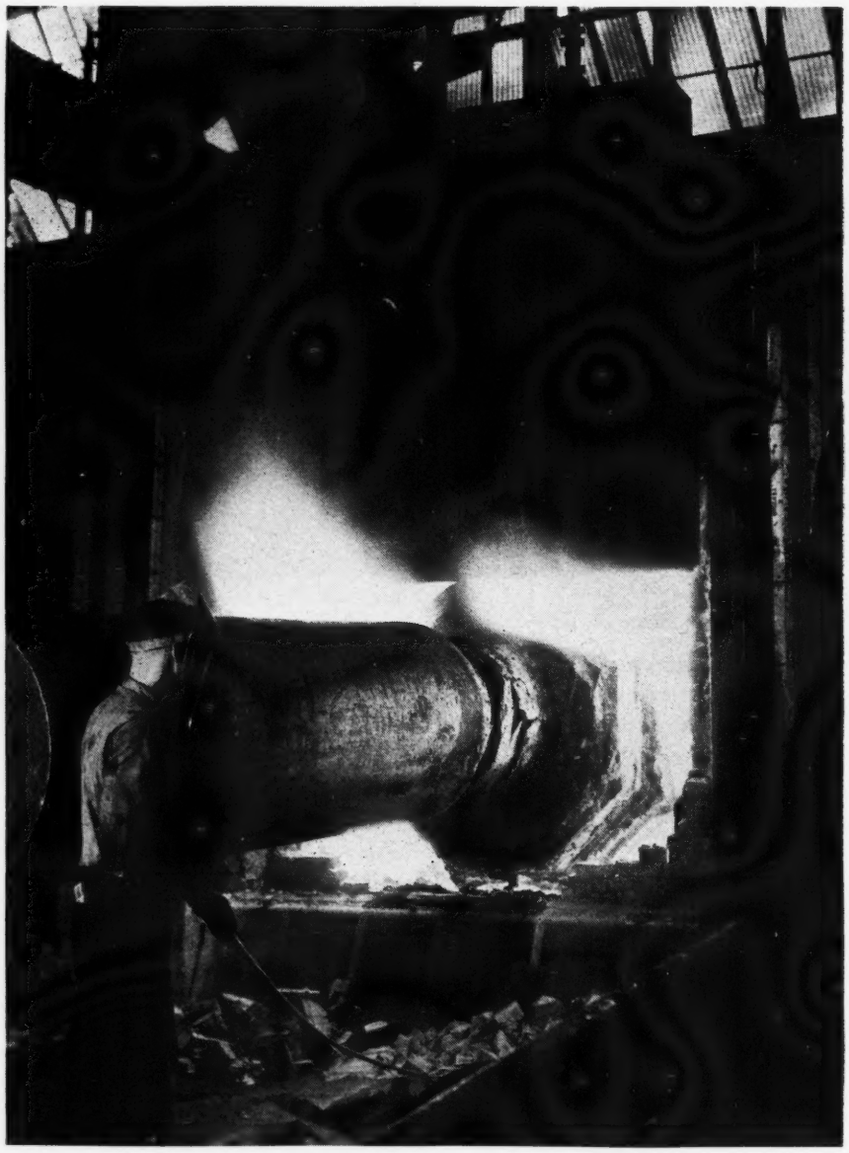
Air Conditioning Priorities

Persons seeking to obtain preference ratings in order to purchase air conditioning or commercial refrigeration equipment were urged by the Air Conditioning and Commercial Refrigeration Branch (War Production Board) recently to submit in detail all the information called for on application forms PD-1A.

The Priorities Section of the branch has been experiencing much difficulty and long delay in attempting to appraise applications because of the sketchy information submitted. Many applications have had to be returned because some of the questions contained in the information sheet accompanying the PD-1A forms have not been fully answered.

Branch officials said that information received in response to Questions 2, 3, and 7 has been particularly sketchy, and the result has been to handicap

(*Continued on page* 172)



One of the largest ingots ever forged in the Middle West is shown coming from the furnace at the Allis-Chalmers Manufacturing Co. The 76-in. ingot, which weighed 192,500 lb, was heated for two weeks until a maximum temperature of 2200 F was obtained. After forging and machining, the ingot ultimately will become the rotor for a large synchronous condenser.

Crowding the turns can mean trouble in piping, too!

When they're riding hell-bent for leather . . .

LOOK OUT! Rounding the turn into the stretch is the place where horse races can be won or lost. A horse gets "pocketed." A rider is jostled. Because there's *added* danger at the turns, anything can happen! TURNS are crucial danger spots in piping systems, too! That's why welding with Tube-Turn fittings is sounder practice wherever pressure and strain are liable to cause leaks, breaks, or pipe connection failures of any kind. There is a Tube-Turn fitting to protect and strengthen *every* piping turn—all types, sizes and weights—returns, elbows, tees, reducers, laterals, nipples, caps, saddles, and flanges.

Write for helpful engineering data book and catalog.

TUBE-TURNS, Inc., Louisville, Ky. *Branch offices:* New York, Chicago, Philadelphia, Pittsburgh, Cleveland, Tulsa, Houston, Los Angeles. *Distributors in all principal cities.*

TUBE-TURN TRADE MARK

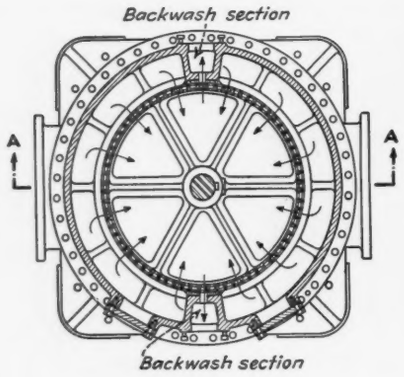
The FIRST WELDING FITTINGS 1ST AND STILL THE BEST

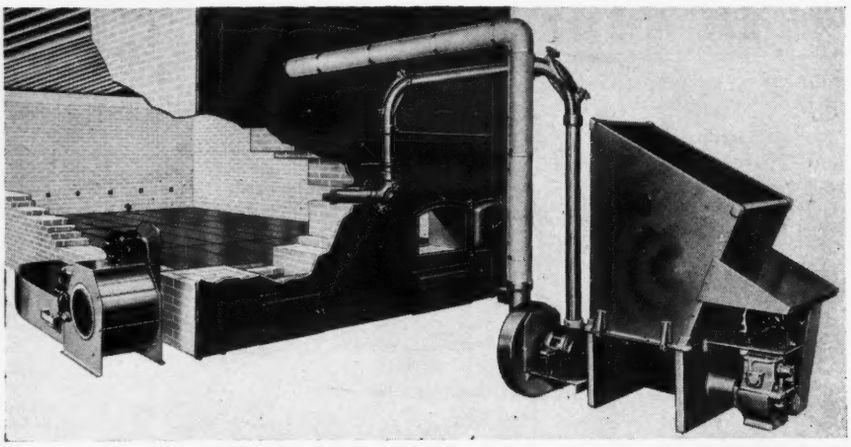
Welding Fittings

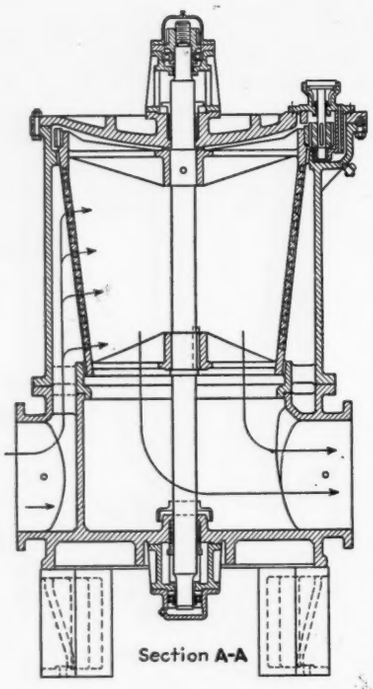
WHEN THE "PRESSURE'S ON" TUBE-TURN FITTINGS WILL GIVE FULL PROTECTION

In this compact, streamlined assembly, welded pipe lines and Tube-Turn fittings *(indicated by check marks)* will harness wild, live steam in one of America's large industrial plants. A failure at any point here would mean more than stopped production and lost man hours. It could mean terrific damage, perhaps loss of life. But Tube-Turn welding fittings give *added protection* where it's needed—at the turns!

WHAT'S NEW IN PLANT EQUIPMENT







Self-Cleaning Water Strainer

BRASSERT AUTOMATIC SELF-CLEANING strainer, developed originally for steel mills, now offered for general industrial and power-plant use, notably cleaning water for cooling or lubricating nonmetallic bearings, hydro seal glands, boiler feed (ahead of softener and sand filters), condensers, heat exchangers, intercoolers, etc. Water under pressure passes from outside to inside of slowly rotating cone drum through many inserted screening disks of any desired mesh. Clear water discharges at bottom right (sketch). Machined cone surface (lapped fit) slides past vertical internal slot in housing, where pressure in drum backwashes clinging impurities from passing strainer disks.

To maintain suitable relative pressures for filtering and backwashing, the unit must be installed on discharge side of pump and must in turn discharge against a minimum head of 20 psi. Units built to handle up to 30,600 gpm. Standard model safely withstands 125 psi and has rated head loss of 1½ psi. Normally backwash runs 2 to 5% of total influent water. *H A Brassert & Co, 60 East 42nd St, New York, N. Y.*

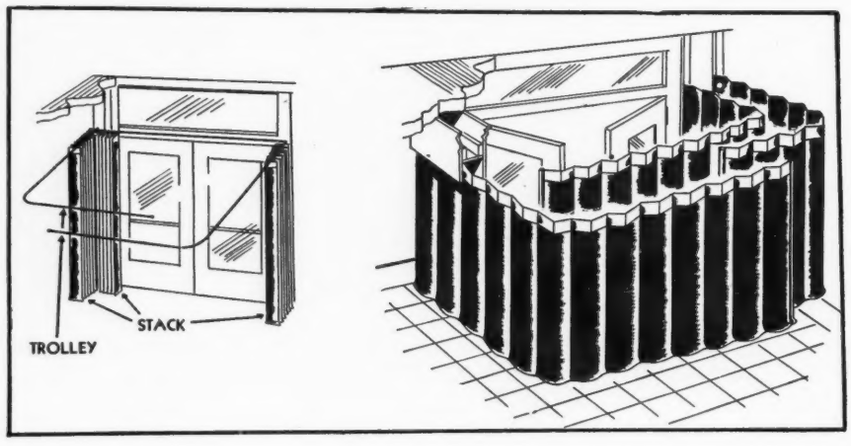
Spreader Stoker

PNEUMATIC SPREADER STOKER with separate undergrate fan unit is said to be able to burn efficiently lower grade bituminous, sub-bituminous and lignite coals. Coal is conveyed and distributed on a stream of air and hot gases; fines burn in suspension, utilizing conveying air for combustion. Larger pieces form a shallow fuel bed on grate. Stoker can be located anywhere within a reasonable distance of boiler front, and coal is fed automatically either from a large capacity hopper or directly from the bunker. Capacities range from 30 to 1000 bhp. *Iron Fireman Manufacturing Co, Portland, Ore.*

Blackout Partition

BLACKOUT PARTITION works on an accordion principle, assuring unusual flexibility. Partition derives its accordion-like operation from specially-designed hinge lock, self-spacing hinge plate at the top. Folding on itself, it has a roller assembly traveling easily on an overhead track. A vertical pipe connected to the lead trolley and extending to approximately 6 in. from the floor, concealed in a loosely fitted front hem, gives rigidity to the front of the partition and serves as a standard. Partition is attached to walls with screws or nails to a covered wooden cleat extending full length of partition. When not in use, partition can be folded to the wall and no valuable space is consumed or lost. Illustration shows arrangement of trolley and stack, and

(*Continued on page* 138)



Some *kinks* that PIPING POINTERS taught me*

*MAINTENANCE TRAINEE

...THAT PULLING UP A VALVE with the wrench on the unsupported end puts a severe strain on the body—that it may twist the valve and cripple its working parts, cause early leakage of the seats and shorten the life of the valve. Crane "Piping Pointers" showed me the right way—with my wrench on the pipe end of the valve. You get a firmer grip this way; pulling-up is easier with less chance of hurting the valve.

...THAT RODDING OUT of viscous and tarry fluid lines can be done easier and faster by installing cross fittings instead of elbows at the 90° turns. You'd be surprised the time it saves on lines requiring frequent cleaning. There's no need to tear them down—you just remove the plugs and work in either direction—another "kink" that helps keep production lines moving.

...THAT INSTALLING VALVES for easy operation is important in controlling speed and quality of production—to safety of processing equipment as well. You can't expect production workers to open valves fully, regulate them properly, or close them tight, if getting at them is difficult and dangerous. Yet, improper operation quickens wear on valves and often slows production.

HOW TO KEEP YOUR PLANT GOING BETTER!
11 SIMPLE WAYS TO GET BETTER SERVICE FROM PIPING EQUIPMENT
HELPFUL HINTS ON CHOOSING VALVES FOR BETTER PIPING SERVICE
TIPS ON VALVE TRIM

...TAKE IT FROM ME, these Crane Shop Bulletins are sound and practical for training new men—for veterans as well! They're full of helpful "kinks" that make piping equipment work better. They're ideal for shop or classroom use. They're genuine aids to Victory and Crane is giving them *free* to any plant or piping man. Just ask your local Crane Representative or write to the address below.

CRANE

CRANE CO., GENERAL OFFICES:
836 S. MICHIGAN AVENUE, CHICAGO

VALVES • FITTINGS • PIPE
PLUMBING • HEATING • PUMPS

NATION-WIDE SERVICE THROUGH BRANCHES AND WHOLESALERS IN ALL MARKETS

Will To Win . . .

Clifton Fadiman, familiar master of ceremonies of the radio program, *Information Please*, passes on the story of a Hungarian aristocrat who, while eating a quick lunch between trains, was recognized by a boorish acquaintance.

"My dear Count, how are you?"

"Umph."

"And how is the Countess?"

"Dead."

"How shocking! It must be terrible for your daughter."

"She's dead."

"But your son —"

"Dead! Everybody's dead when I'm eating!"

I think that we can all profit from that story. Thus far, many of us have been doing little to help win this war beyond talking about it. We've been shouting slogans and wearing "V's for Victory" while on our way to stock up before some new rationing or allocating plan takes effect.

Let's stop talking, every one of us, and go to work. In our vital job today, talk is as undesirable as it was while the Count ate.

I am thinking of two kinds of talk. One is the rumor-mongering and free advice indulged in by arm-chair admirals and club-car generals, the "straight dope" that may or may not be reliable. If it isn't, it just helps develop a case of national jitters. If it is, it may be information that the enemy wants.

The other kind of talk is the kind that small boys use instead of fighting—the "my Pa can beat your Pa" which does nothing but stir up trouble. It was that kind of talking and thinking that had us asleep at Pearl Harbor. Let's face the fact that we're fighting a tough enemy and not waste time in wishful thinking and rose-colored forecasting.

Let's show determination and spirit—the "will to win." Remember the February bombing scare on the West Coast and the resulting waste of shells? General MacArthur radioed right afterward, "If you can hold the Coast for a month, I'll send reinforcements."

Let's show that spirit. Let's hold the Coast—*and our tongues.* Work, not talk, is the essence of the "will to win."

George Edwards

Engineer

KEARSARGE BOILER GASKETS are virtually standard equipment for sealing manholes, handholes and tube plates.

They're tougher and they stand up longer. Made of a strong, durable asbesto-metallic cloth treated with a special heat-resistant compound, they give a tight seal every time—eliminate shutdowns for replacement. Their long, economical service is typical of the complete line of J-M Packings and Gaskets.

• • •

For full details, write for the new J-M Packing Catalog, PK-12A. Johns-Manville, 22 East 40th Street, New York, N. Y.

JM PRODUCT

Johns-Manville PACKINGS & GASKETS

THERE'S A DISTRIBUTOR NEAR YOU

"MEGGER" INSTRUMENTS IN A WORLD AT WAR

In times of peace our "Megger" Insulation and Ground Resistance Testers are used to protect electrical equipment from failure, to insure continuous service and to safeguard human life.

Now, in a world at war, with machines and men at overload production, these vital protective functions of our "Megger" instruments have multiplied to the point where, at the moment, we are somewhat delayed in meeting the urgent needs of both government and industry.

Thus it is that **"Megger" Testing** in war time ranks equally in importance with the generators, motors and cables that must be tested and retested **that they shall not fail.**

If you are so fortunate as to own a "Megger" Insulation Tester —TAKE TIME TO USE IT. Send immediately for our Pocket Manual of "Megger" Practice and other bulletins which contain valuable information on how to make "Megger" tests, with directions for using all types of the "Megger" instruments. Place this literature and your "Megger" instrument in the hands of your best electrician with instructions to find the weak spots in your electrical system.

If your problem is one of ground resistance measurements, send for our Technical Bulletin on that subject. (No charge or obligation for our literature.)

If you need a "Megger" Tester, either temporarily or permanently, **write, 'phone or wire us.**

JAMES G. BIDDLE CO.

1211-13 Arch Street • Philadelphia, Pa.

"MEGGER"

TRADE MARK REGISTERED U.S. PAT. OFF.

More Boiler Capacity

(*Continued from page* 81)

A great deal has been learned recently about the effect of excess air on slag conditions throughout a furnace and boiler unit. Excess air affects furnace temperatures, as well as the fusing temperature of the slag and flyash. Higher excess air actually results in the ash and slag collected on the walls and tube banks having a higher fusing temperature than if the excess air were lower. This means that the actual slag and ash accumulation in many furnace walls and tube banks is higher by 100 to 400 F than the usual laboratory standard determination, which is conducted in a reducing atmosphere. In zones of low excess air the slag fusing temperature may be as low as the laboratory results, or even lower, from a segregation that causes the iron content to be greater than the average. The higher the iron content of the ash the greater are the effects which result largely from the differences in the oxides of iron.

Slag Problems

Even after taking all precautions possible there still may be slag cleaning problems to face. Many recent boiler units are so arranged that a reasonable number of retractable blowers keep the unit economically clean. More hand lancing may be needed throughout all parts of some boiler units if high-temperature alloys needed for soot and slag blowers are greatly restricted.

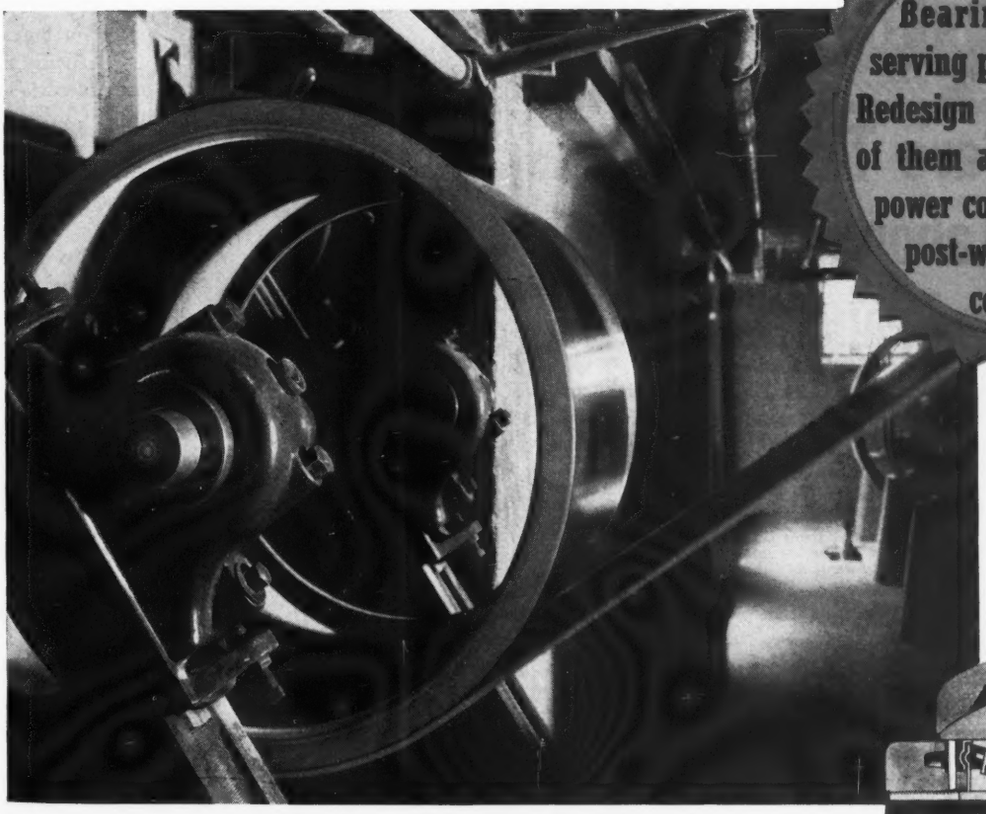
Outages of slag-tap furnaces are occasionally caused by slag leaks, or leaks of the water-cooling tubes around the tap hole. Slag leaks usually result from the erosive nature of molten iron-sulfide when it accumulates on the floor under the regular slag. This sulfide, and sometimes metallic iron, are the result of coarse pulverizing, deficiency of air, or maldistribution from burners. Some floor constructions are better safeguards against leaks than others, but in many cases the leaks are caused by insufficient care given to construction details at corners.

Air leakage throughout the boiler unit should be held at a minimum and frequently checked by gas analyses.

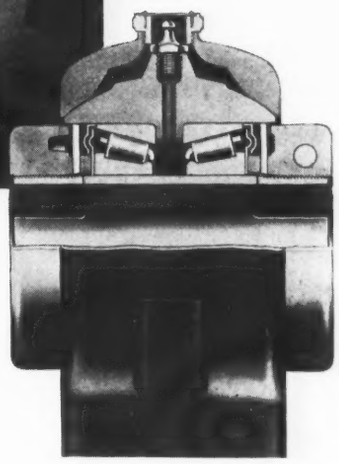
Superheat control is greatly affected by excess air, and sometimes the proportions of surfaces or their relative cleanliness brings about an operating condition where efficiency is sacrificed for the benefit of superheat and vice versa.

Most plants have meters and instru-

Dodge Clamp Sleeve Type Pillow Blocks equipped with Timken Bearings supporting large idler pulley in factory drive.



TIMKEN Bearings are conserving power for Victory. Redesign now to use more of them and you will hold power costs down during post-war competitive conditions.



Sectional view of Dodge Clamp Sleeve Type Pillow Block showing application of Timken Bearings.

Power waste always was bad business. Now it is almost criminal as well. Every unit of power that is not made to do its quota of useful work is a blow at the National Victory Program.

Most power loss occurs in transmission. Modern transmission equipment like the Dodge-Timken Pillow Blocks shown in the photograph will stop it, for friction—arch power waster—is eliminated.

There is, furthermore, a considerable saving in lubricant; no contamination of product through lubricant leakage; no wear on shafts.

If your power costs seem higher than they should be, check up on your power transmission equipment. It will be much more economical to replace obsolete pillow blocks and line shaft hangers now. The longer you delay, the more you will lose.

TO ASSURE VICTORY
BUY UNITED STATES
DEFENSE BONDS & STAMPS

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

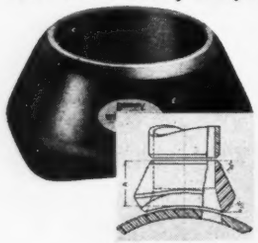
Manufacturers of Timken Tapered Roller Bearings for automobiles, motor trucks, railroad cars and locomotives and all kinds of industrial machinery; Timken Alloy Steels and Carbon and Alloy Seamless Tubing; and Timken Rock Bits.

TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
TAPERED ROLLER BEARINGS

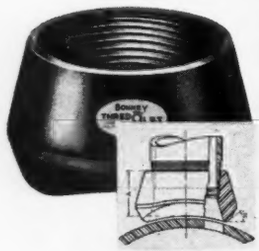
WELDOLETS·
TRADE MARKS - REG. U. S. PAT. OFF.
THREDOLETS
. . . Welded Outlets for Piping . . .

How to Save Time, Materials and Labor in Making Right-Angle Branch Pipe Outlets

BECAUSE Bonney WeldOlets, ThredOlets and Socket-End WeldOlets eliminate all cutting and threading of the main pipe, they will save time, material and labor in making right-angle branch pipe outlets. Their installation is extremely simple and easy as shown in the illustrations.

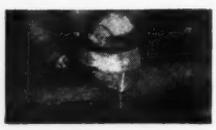


WELDOLET



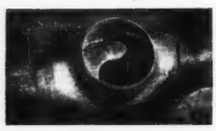
THREDOLET

Socket-End WELDOLET

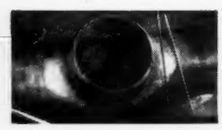


1—Select the position of the outlet. Rub the fitting over the pipe several times to remove scale, dirt—mark center lines—tack into position.

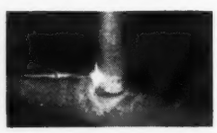
2—Tacking is done in enough places to insure its desired position. No clamps are necessary. Then weld, following and filling the bevel along the base of the fitting. A junction of full pipe strength is assured.



3—When the outlet of the fitting exceeds 2", weld the fitting to the main pipe and then remove the button—in two sections. Where the outlet is smaller than 2" or under unusual conditions on larger sizes, the fitting should be used as a templet and the hole cut in the main pipe first.



4—After the fitting is installed on the main pipe and the button removed, the inside of the joint is in full view for inspection. Interior inspection is impossible with welded pipe-to-pipe intersections, welding tees, saddles, etc. Icicles, scale and excess welding metal are eliminated when WeldOlets, ThredOlets or Socket-End WeldOlets are used. They are removed with the button.



5—The end of the branch pipe is then beveled at 45° and welded to the outlet of the WeldOlet. If ThredOlets are used, the threaded branch pipe is screwed into the outlet of the fitting—or, if Socket-End WeldOlets are used, the branch pipe is slipped into the fitting and an ordinary weld made around the top of it.

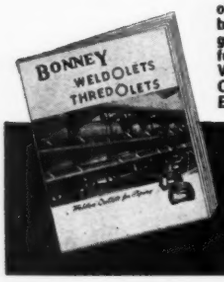
6—The job is then complete. Note the trim, mechanical appearance. External as well as interior obstructions are eliminated, saving materials and reducing the weight of the entire system.

WeldOlets, ThredOlets and Socket-End WeldOlets form clean, unobstructed branch connections. Their funnel-shaped intake aperture reduces turbulence and friction. No templets are required, nor is it necessary to do complicated cutting and fitting.

Standard stock fittings are of drop forged steel (outlets from 1/4" to 12") in size-to-size and reducing sizes. For special applications, or where unusual conditions exist, they can be supplied in Toncan Iron, wrought iron, brass, Monel, Everdur, etc. and in sizes up to 24" x 24".

They are suitable for every type of piping installation and for all commonly used pressures and temperatures.

Your local distributor will be glad to tell you the complete story about savings which can be effected, or write for Bulletin WT29—TODAY.



Bulletin WT29—Get your copy of this 20 page book NOW. It gives complete information about WeldOlets, ThredOlets and Socket-End WeldOlets.

BONNEY FORGE & TOOL WORKS
FORGED FITTINGS DIVISION
ALLENTOWN, PA.

ments, and many have automatic control. For the best results all of this equipment must be systematically checked, and adjusted if necessary. Often this equipment is of great value in keeping conditions correct for maximum output as well as best efficiency, and is also assurance against serious accidents caused by failure of pumps, fans, or other major equipment.

The present tendency is duplication of design for any units now being installed. We are approaching a shakedown period during which the relative advantages and disadvantages of the many varied units recently designed can be learned if proper records are kept and proper comparisons made. This should lead to better units in the future, with a trend toward standardization.

Argument Corner

(*Continued from page* 120)

serious reduction in the cross-sectional area in the curved portion of the old head and in the shell plate close to the junction of the two. That may be so when the upper head is flanged inwards, but in hundreds of vertical tubular boilers that I examined I found that when the upper tube sheet or head is flanged outward, as in a Manning boiler, corrosion results from moisture at the lowest point. The lowest point does not include the flanged part of the head nor does it include the shell plate. I have yet to find appreciable deterioration by normal corrosion if this corrosion is due to rain, condensate from combustion, or tube leakage at other points.

I agree entirely with Mr Sterrett's concluding paragraph that the step-back system of welding should be used to prevent cumulative stresses. Segmental welding or the step-back system should prevent undue locked-up stresses.

I feel that Thomas Rogers over-emphasizes the matter when he says, in the March number, that the repair on a vertical tubular boiler described on page 111, November POWER, is unsafe. This method of welding a new head is described in detail on page 55 of the Indiana State Boiler Code. Even though this way of doing the job does not strictly conform with the recently adopted "Rules for Repair by Fusion Welding to Power Boilers and Unfired Pressure Vessels," of the National Board of Boiler and Unfired Pressure Vessel Inspectors is no reason for say-

ASK YOUR BOILER TO MATCH THIS RECORD

Such performance is not unusual with Coppus-Dennis Fanmix Gas Burner on natural gas.

Gas and air are combined in a perfect mixture by the exclusive "pinwheel action" described in Bulletin 410-3.

Ratings can be increased, as Fanmix gives more heat release per cubic foot of furnace volume. Maintenance of tubes and furnace linings is reduced due to discharging "radiant heat" and uniform temperature inside whole furnace. There are no drifting "hot spots." Check the coupon for the bulletin which describes many other advantages of this new "Blue Ribbon" product.

COPPUS

ASK YOURSELF:

"WHICH IS THE BETTER BUY FOR A SMALL LOAD?"

For 150 HP and down, the answer is Coppus "Blue Ribbon" Steam Turbine.

From Coppus you can get six frame sizes-smaller than are included in most lines. Keep your investment proportional to the load — specify Coppus.

It's a "Blue Ribbon" product, so you can expect trouble-free performance. Reason why described in Bulletin 135-9.

COPPUS

COPPUS BLUE RIBBON PRODUCTS

DESIGNED FOR YOUR INDUSTRY...ENGINEERED FOR YOU

COPPUS ENGINEERING CORPORATION

325 Park Avenue, Worcester, Mass.

Sales Offices in THOMAS' REGISTER. Other "Blue Ribbon" Products in SWEET'S.

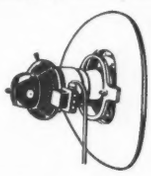
You'll get valuable ideas from these free bulletins on other Coppus Blue Ribbon Products

(Check the ones you want)

☐ Coppus Unit Air Filters. For industrial ventilating and air conditioning systems. Bulletin F-320-5.

☐ Coppus Heat Killers. Keep production up by keeping men cool. No stale air recirculation. Air is directed. Bulletin 160-5.

☐ Coppus Cable Manhole and Tank Ventilators. For confined working spaces. Bulletin 163-1.



☐ Coppus Boiler Manhole Blowers and Exhausters. For cooling boilers, drums, etc. Bulletin 161-3.

☐ Coppus Welding Exhauster. For exhausting welding fumes and other injurious gases from confined working spaces. Bulletin 168-1.

☐ Coppus-Dennis Fanmix Gas Burner (described in this ad).

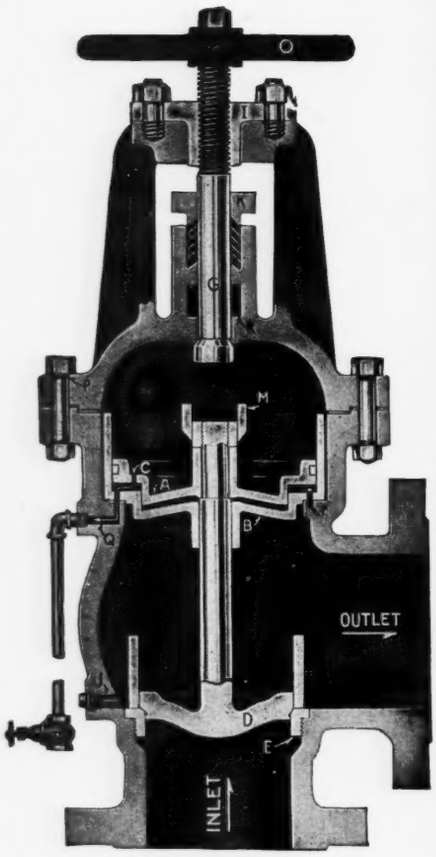
☐ Coppus Steam Turbine (described in this ad).

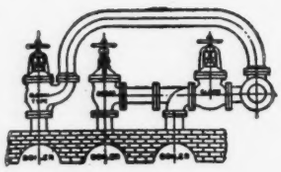
NAME.....

COMPANY.....

ADDRESS .....

Golden Anderson
SPECIALTY
VALVES





NON-RETURN

• A tube bursting in one boiler means that the contents of every boiler in that battery are coming through that rupture *unless* there's a good non-return valve to stop it. To guard against such destruction, install an efficient, non-return valve that *will not* and *cannot* stick — such as the G-A non-return valve shown here. As far as we know, none of the many thousands in use has ever failed.

Safeguard the most valuable thing in the world—human life — with these G-A non-return valves.

WRITE TODAY
FOR FREE CATALOG

also

Altitude Control . . .
Pressure Reducing . . .
Throttle and Emergency Stop . . . Check Valves etc.

GOLDEN-ANDERSON VALVE SPECIALTY CO.
FULTON BLDG. PITTSBURGH, PA.

ing that the repair is unsafe. Only recently dissatisfaction with some of the rules in this code was expressed in the State of Ohio. The only difference in the repair described in the Indiana Code and the one I suggested is in the way in which the head is flanged. However, this does not make any difference in the repair.

The rules for repair by fusion welding referred to by Mr Rogers are new and will probably be changed when we have more experience. For example, one section of these rules advocates welding a patch flush with an unstayed cylindrical part of a boiler drum. A number of insurance companies hesitate to approve such a repair. It is my opinion that the repair may be dangerous. Also, a number of states have hesitated to adopt these rules, even though they were represented on the National Board.

The New York Boiler Code permits fusion welding in stayed areas where the strength of the repair does not depend upon the weld. In the repair under discussion the tubes fully stay the tube sheet, but Mr Rogers objects to welding the sheet to the flange of a tube sheet that is fully riveted to the shell of the boiler. This is one of those problems on which opinion has not yet crystallized and on which there probably will be a lot more discussion before it does.

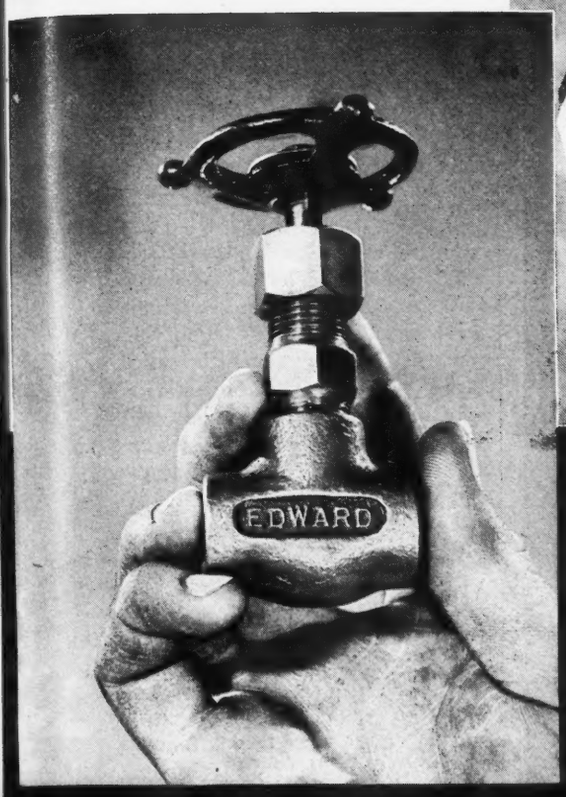
Cleveland, Ohio A G WIGGINS

Not the Operating Engineer's Responsibility

IN REFERENCE TO THE ENGINE SPEED QUESTION published in the November 1941 issue of POWER, as propounded to engineers is as follows: "Assume a shaft governed steam engine without a nameplate on the engine or generator. The engine is idle and must not be started to permit use of the speed indicator. How can the engine speed be found?"

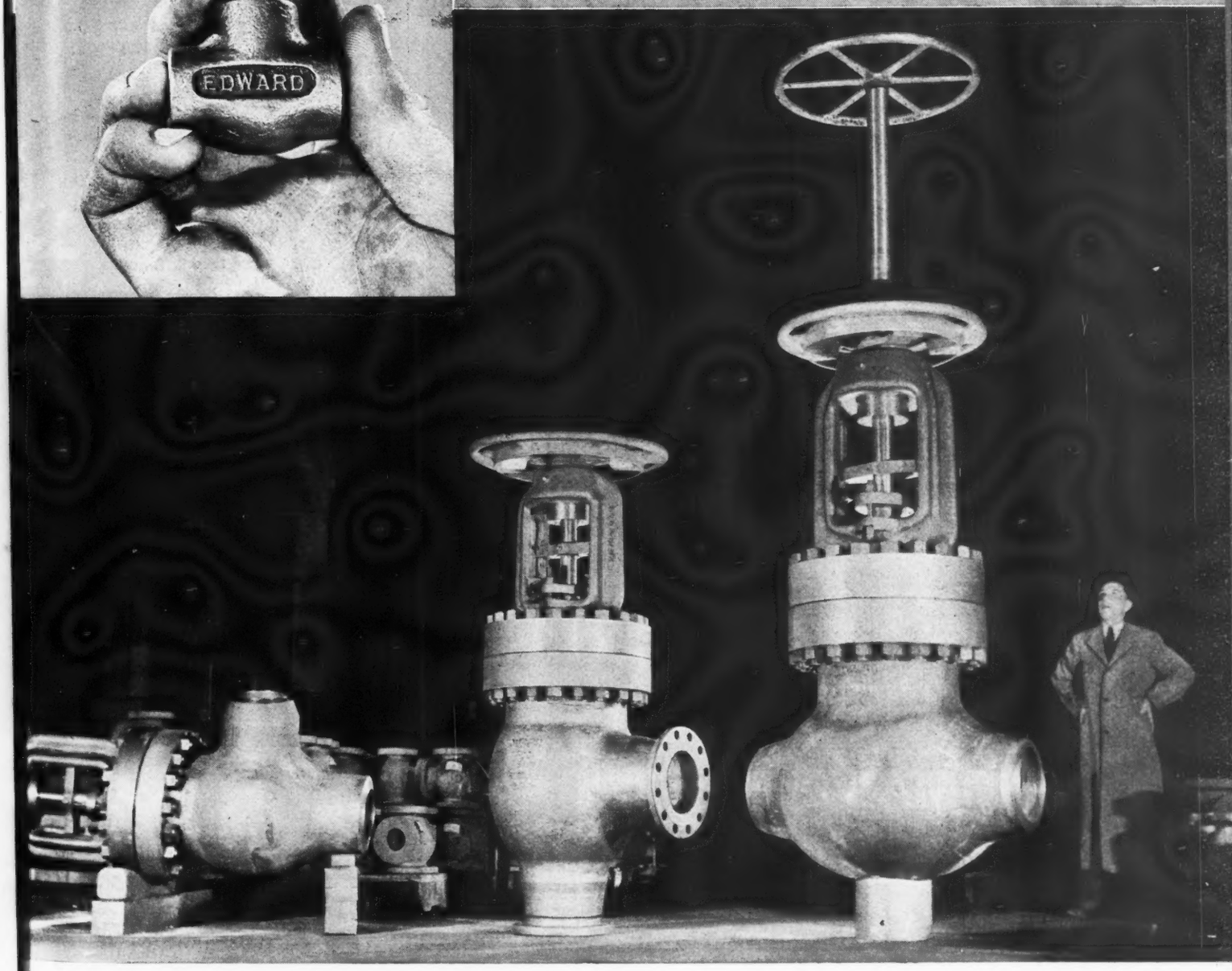
To operate a piece of electrical equipment that does not bear the maker's name, trademark, or other identification symbol, is a violation of the National Electrical Code. See Paragraph No. 1117—Page 22; and Paragraph No. 4452—Page 171—1940 issue of the National Electrical Code.

The question would imply that the engine is driving a generator, and, regardless of the speed of the engine, the most important consideration is the characteristic of the generator. I would say that the proper answer to this question is that a man should not start any piece of equipment that does not bear proper identification; after all, it is not for the operating engineer to assume the responsibility for the design of any



"BABY" OR "GIANT"

EDWARD *PLUS VALUE* VALVES MEAN MINIMUM MAINTENANCE

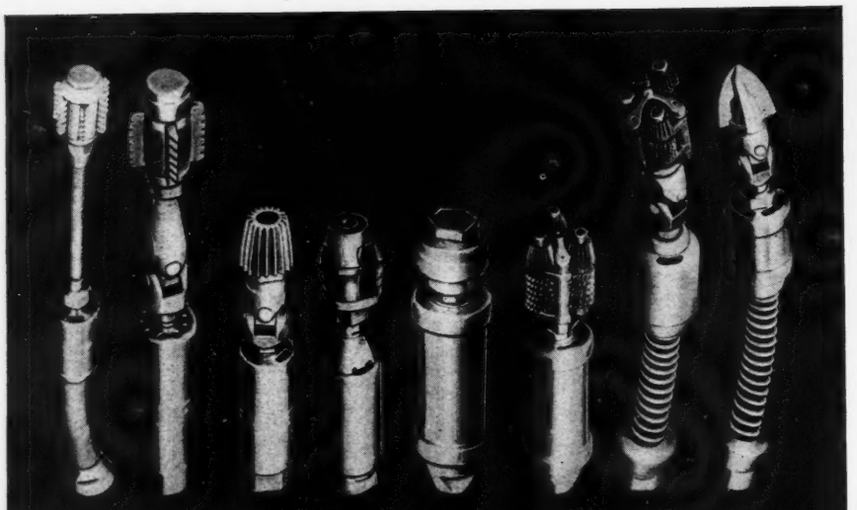


THE
EDWARD
VALVE &
MFG. CO., INC.

EAST CHICAGO
INDIANA

BIG or little, Edward valves are built to stay on the job — without constant attention. Today, when time is so precious and operating interruptions so costly, Edward dependability is more important than ever. All Edward valves have one thing in common — basic fitness for tough service. The tiny ⅛ in. forged steel gage valve for many services (upper left) and the gigantic 10 in., 12 in., and 14 in. alloy steel valves for 1500 lb, 950 F service are built to equally exacting specifications. Sound design, careful selection of performance-proved materials, painstaking workmanship and rigid inspection at every stage of the manufacturing process — these are the principles behind Edward's tradition of "plus value" valves.

EDWARD *Steel* CAST AND FORGED VALVES



TIME SAVED IN TUBE CLEANING SPEEDS UP OUR WAR PRODUCTION

Time is more precious now than ever before. Every hour—every minute—of tube cleaning time that can be saved—every extra hour that a boiler can operate between cleanings—means *increased* production of war materials essential for our ultimate victory.

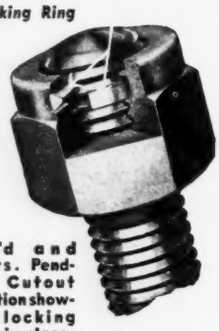
Wilson Tube Cleaners clean every kind and size of straight or curved tubes *faster, better* and *more economically* because they have *extra speed,* extra power and extra efficiency. Plants engaged in the production of essential war materials are finding Wilson Tube Cleaners and accessories of great assistance in increasing their efficiency and their output.

Write for the name of our representative nearest to you or for a copy of our NEW forty page catalog which is just off the press.

THOMAS C. WILSON, Inc.
PIPE AND TUBE CLEANERS EXCLUSIVELY
47-28 37th Street Long Island City, N. Y.

WON'T SHAKE LOOSE

Locking Ring



Pat'd and Pats. Pending Cutout section showing locking ring in place.

UNSHAKO
Reg. U. S. Pat. Off.
SELF-LOCKING NUT

The locking ring within the Nut (see illustration) creates an automatic counteracting force which prevents loosening and defeats vibration. Yet, it can readily be backed off with a wrench and reused over and over again. Write for details.

STANDARD PRESSED STEEL CO.
JENKINTOWN, PENNA. BOX 577

piece of equipment; nor is it his responsibility to delve into that phase of the work. His work is to properly maintain equipment and keep it in operation.

Determination of speed, allowable steam pressure, and characteristics should be that of the design engineer. If there is none such in the employ of the company owning the equipment, a competent engineer should be called to supply this necessary information. We here would not ask anyone to operate any piece of machinery not bearing a nameplate with suitable identification.

Wheeling, W. Va., LAWRENCE MEHARG

Many Things Affect Motor Commutation

QUESTION NO. 2 OF READERS' PROBLEMS which was published in the January issue of POWER is interesting from many standpoints. In checking for trouble of this kind, we must assume several conditions. Supposing that at the time all brush replacements were made, the brushes were sanded to fit the commutator, that the brushes slipped freely in the brushholders and, that proper adjustments as to brush tension were made.

Some possible sources of trouble, if the motor *has not* been down for repairs or overhaul, can be bad or worn bearings which affect the air gap, a grounded main field winding, or a grounded interpole winding on an interpole machine.

Other possible trouble sources if the motor *has* been down for repairs are: interpole connections reversed, improper spacing of one brushholder arm, improper spacing of diametrically opposite brushholder arms with respective sets of brushes straddling the proper plane of commutation. We might also attribute this trouble to replacing the brushholders with larger ones, so that the brushes cover too many commutator bars.

The proper hookup of the commutating or interpole field on a motor, makes the polarity of the interpole the same as that of the main pole it precedes in the direction of rotation.

On a direct-current machine, the greatest arcing takes place at the point where the current leaves the machine, which in this case would be the negative brush. However, the color of the arc is a warning as to the damage it may be causing. A light pin-fire arc, bluish-white in color, is not particularly damaging. It is the reddish-yellow arcing that we should correct.

Rantoul, Ill. R R RICHART

WHEN LOADS REACH PLANT CAPACITY

HERE'S HOW NONPAREIL CAN HELP

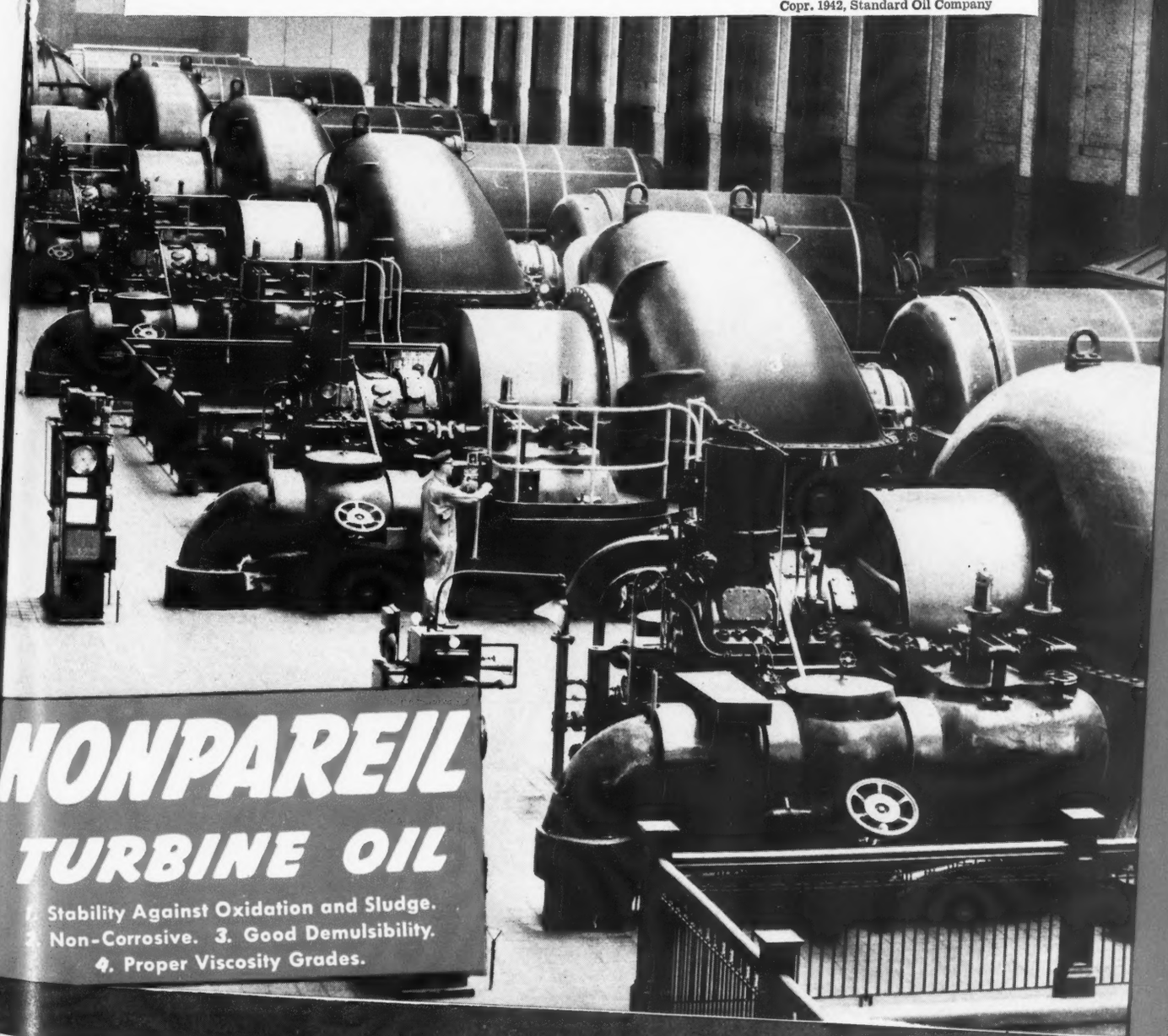
● Is THE TIME NEAR when every minute of turbine operation will be needed to meet your power demands? If so, it's time to find out how Nonpareil Turbine Oil can help meet these additional requirements.

Since Nonpareil remains extremely low in acidity, troublesome emulsions are avoided. Since Nonpareil forms no sludge, periodic cleaning of oil lines and tanks is eliminated. These qualities save many man-hours of labor even though this work has been done in the past at the time of regular overhauling.

With turbines operating continuously, the demands on your turbine oil will be much more exacting. Cleaning oil systems, treating or replacing oil must be done more frequently. These may even cause serious outages. They can be avoided with Nonpareil. It is guaranteed to last as long as your turbine.

Let a Standard Lubrication Engineer explain to you or your operating men how Nonpareil can help you in many ways during this emergency. Write Standard Oil Company (Indiana), 910 S. Michigan Ave., Chicago, Ill., for the Engineer nearest you. In Nebraska, write Standard Oil Company of Nebraska at Omaha.

Copr. 1942, Standard Oil Company



NONPAREIL TURBINE OIL

1. Stability Against Oxidation and Sludge.
2. Non-Corrosive. 3. Good Demulsibility.
4. Proper Viscosity Grades.

STANDARD OIL COMPANY (INDIANA)

LUBRICATION ENGINEERING • • • LUBRICATION ENGINEERING • • • LUBRICATION ENGINEERING • • • LUBRICATION E

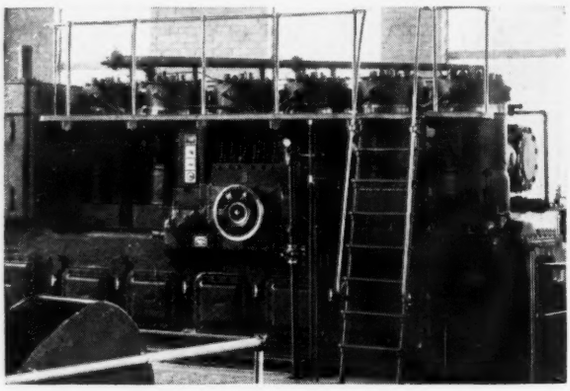
...LUBRICATION ENGINEERING...LUBRICATION ENGINEERING...LUBRICATION ENGINEERING...LUBRICATIO

CYLINDERS CLEAN... RINGS FREE... POWER UP, ON 15-YEAR-OLD DIESEL WITH NONPAREIL DIESEL OIL

It seemed, to the operator in a Wisconsin light plant, that age was creeping up on his 15-year-old Diesel. It was definitely losing its pep. But age wouldn't explain why a five-year and a two-year old unit were also giving him trouble.

The engines were inspected twice a year. Each time, some of the rings were stuck. There were signs of blowby.

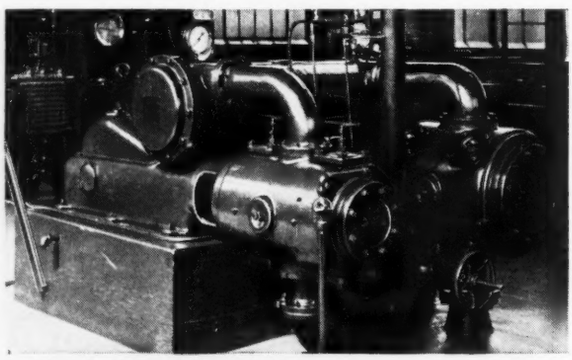
A Standard Lubrication Engineer pointed out to this operator some of the clean records Nonpareil Diesel Oil



was making on engines of the same make and age. A test was arranged.

With Nonpareil, even the 15-year-old Diesel doesn't act its age. It has picked up power and every inspection shows rings free and cylinders well lubricated.

Make next time the last time you clean and free up rings. Put in Nonpareil Diesel Oil. A Standard Lubrication Engineer will recommend the grade you need.



STANOIL STANDS UP IN SEVERE COMPRESSOR OPERATION

Oil in a new compressor at a Michigan foundry turned black and showed indications of deterioration in just two weeks. The operator was puzzled. This oil had been used successfully for some time on other equipment in this plant. A Standard Lubrication Engineer was asked for his suggestion.

He found that operating conditions were severe on this compressor. It ran almost continuously, seven days a week, in dusty surroundings. The Engineer decided it was a job for Stanoil—and it proved to be. The same fill of Stanoil has been in this compressor for two months, and there is no sign of oil failure.

STOPS CHATTER... AND WEAR ON KILN GEARS WITH CALUMET VISCOUS LUBRICANT

High temperatures and abrasive dust complicated the lubrication of girth gears on a cement kiln in Michigan. Several gear lubricants were tried . . . some were thrown off because of the high temperature—others balled-up from the dust and dropped off—none eliminated the metal-to-metal chatter and wear.

The plant superintendent welcomed a test suggested by the Standard Lubrication Engineer. Calumet Viscous Lubricant, which at that time was a newly developed product, was put on the hottest and dustiest locations—and it *stayed* there. Drippage was eliminated to the extent that gears needed greasing just one-third as often.

HERE'S ONE PROBLEM ON WHICH YOU CAN GET REAL HELP... LUBRICATION

What new equipment is available . . . where to get replacement parts . . . how can you get more power? The list of new problems you have is long and varied. Many details must be neglected. But you don't need to neglect the important detail of lubrication. A Standard Lubrication Engineer near your plant is ready to take over your troublesome lubricating problems . . . he may have the answer to many of your questions about maintenance and power consumption. Call the local Standard Oil Company (Indiana) office listed below, or write 910 South Michigan Ave., Chicago, Illinois, for the Engineer nearest you. In Nebraska, write Standard Oil Company of Nebraska at Omaha.

COLORADO
Denver

ILLINOIS
Chicago
Decatur
Joliet
Peoria
Quincy

INDIANA
Evansville
Indianapolis
South Bend

IOWA
Davenport
Des Moines
Mason City

KANSAS
Wichita

MICHIGAN
Detroit
Grand Rapids
Saginaw

MINNESOTA
Duluth
Mankato
Minneapolis

MISSOURI
Kansas City
St. Louis
St. Joseph

MONTANA
Billings

NORTH DAKOTA
Fargo

SOUTH DAKOTA
Huron

WISCONSIN
Green Bay
La Crosse
Milwaukee

WYOMING
Cheyenne

OIL IS AMMUNITION USE IT WISELY

The 2-WAY STEAM TRAP with

SIMPLIFIED PIPING
NO STEAM LOSSES
INSTANT HEAT and
MAXIMUM TEMPERATURES

This 2-way steam trap that connects either as an elbow or straight-in-line saves plenty of time, trouble, material and labor. That's important. But besides that, Anderson Super-Silvertop prevents steam losses because it closes tight between discharges—the guided bucket *insures* positive valve closing.

Maximum temperatures are only possible when the system is drained dry and free of entrained air. You automatically get this condition from the positive action of the inverted bucket on all Super-Silvertops. Where abnormal air conditions exist use traps equipped with Thermal Air Eliminators.

Get these important features for your equipment—specify Anderson Super-Silvertop, the steam trap that saves time, space, fittings and labor. Described fully in the book "How To Choose a Steam Trap," a helpful reference volume that should be on your desk. Send today for your copy—it's free.

THE V. D. ANDERSON COMPANY
1934 WEST 96th STREET • CLEVELAND, OHIO

★ In these days of shortages we don't need to know how to *choose* a new hoist —but how to *use* an old one more efficiently, and how to make it last longer.

So—get busy with the grease gun! Where properly lubricated and maintained, many **WRIGHT HOISTS** have given constant, trouble-free service for 20 and 25 years. We have known other hoists to be so badly abused they were ruined in *two* years. Your **WRIGHT HOIST** will last indefinitely if you treat it right.

If your hoist is under constant use, as on assembly line work, inspect and lubricate it every month. If it is subjected to ordinary occasional service, then perhaps lubrication every three months and inspection every six months is sufficient. But keep your load chain well lubricated at all times. A lubricated chain will *far* outlast a dry chain.

Conserve steel and maintain production schedules by regular inspection and lubrication.

WRIGHT MANUFACTURING DIVISION
York, Pa., Chicago, San Francisco, New York

In Business for Your Safety

ACCO

AMERICAN CHAIN & CABLE COMPANY, INC.
BRIDGEPORT, CONNECTICUT

New Equipment

(*Continued from page* 124)

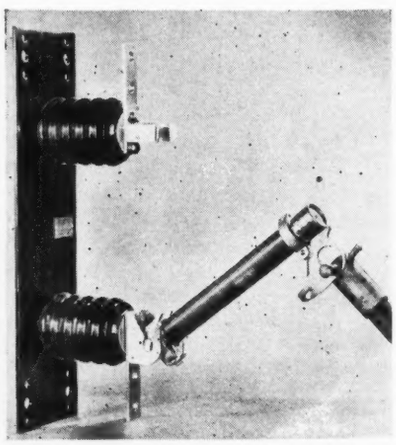
also a typical application on a double door. *New Castle Products, New Castle, Ind.*

Torqometer

NEW DESIGN OF TORQUE-MEASURING instrument said to be free from any inherent friction, assuring that torque readings shown on instrument dial are accurate and not affected by friction in the tool. Tool has no springs or bars that could take on a permanent set and influence dial readings. Entire torque-measuring action and dial mechanism built as a complete unit, and streamline case and handle are simply a protection for instrument and a means of comfortably using it. Tool can be preset to any torque load and is used to set a series of volts to an equalized predetermined tension or torque. Instruments are available in seven sizes, with capacities from 0 to 1500 ft lb. The five smallest sizes are available with or without a flashlight signal, and on the two largest sizes this light is standard. *Snap-On Tools Corp, Kenosha, Wis.*

Transformer Fuse

TYPE BAL FUSE combines functions of a current-limiting resistor and a fuse in a compact unit for application on a system of high short-circuit capacity with none of the disadvantages of a resistor and fuse combination. Can be safely applied on largest powerhouse bus, as well as on metering transformer of smallest substation. Interrupting ratings are from 80,000 amp at 2300 volts to 65,000 amp at 22,000 volts. Operation is in either of two ways, depending on magnitude of fault current.



GLOBE STEEL TUBES

. . . "IN THE SERVICE" ABOARD LIBERTY SHIPS

The "Liberty" ship construction program is one of the greatest mass production efforts in all shipbuilding history . . . Globe pressure tubes are part of the huge amount of equipment and materials required — and the Globe Steel Tubes Co. is proud to be identified with this historic "Victory" program.

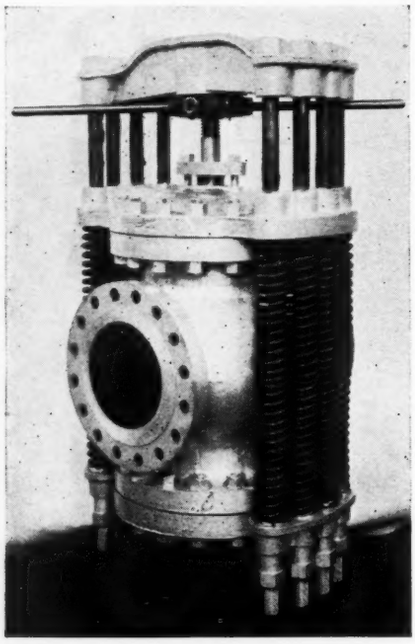
GLOBE STEEL TUBES CO., Milwaukee, Wisconsin

★ BOILER TUBES ★ CONDENSER AND HEAT EXCHANGER TUBES
★ MECHANICAL TUBING ★ STAINLESS TUBES

GLOBE TUBES

1001

MAXIMUM TURBINE PROTECTION



with DAVIS NO. 265 TURBINE BLEEDER RELIEF VALVES

- **SENSITIVE CONTROL!** — Multiple spring loading provides fast, accurate, pressure relief at valve setting, with much less spring load accumulation than in single spring-loaded types. From 2 to 12 batteries of springs are used, depending on size of valve and pressure at which it is to relieve.
- **LARGE PORT OPENING!** — Full port openings of large valve disc gives lower steam velocities, smoother flow. One Davis No. 265 can often replace several smaller "pop" safety valves.
- **FULL RANGE OF SIZES!** — All pressures—from 5 to 200 lbs. can be handled by valves ranging from 4 inches to 30 inches in size. One large power plant has seven No. 265 Valves on bleeder lines at various turbine stages!
- **SAFETY!** — Multiple spring loading, non-sticking valve, large capacity, rugged construction—all give Davis No. 265's a greater margin of safety in protecting turbines: All add up to extra years of trouble-free service from turbines so protected.

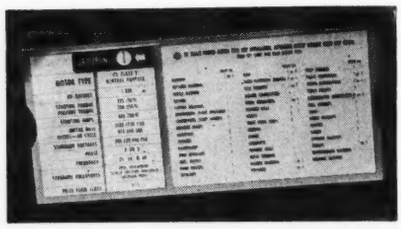
Write today for complete data on the Davis line of valve specialties. Over sixty years of specialized experience stands behind Davis engineers—ready to help you solve your individual plant problems. DAVIS REGULATOR CO., 2540 South Washtenaw Avenue, Chicago, Illinois.

DAVIS REGULATOR COMPANY

On very low fault currents boric acid in main fuse element melts. Since this is spring-operated, current is interrupted at once without melting auxiliary fuse wire. On fault currents of short-circuit magnitude, current flows through both main and auxiliary fuse elements with practically no limiting effects until the auxiliary fuse element melts. *Westinghouse Electric & Mfg Co, Pittsburgh, Pa.*

Motor Selector

POCKET SIZE "SLIDE-RULE" selector for electricians, plant maintenance men and others interested in selection of electric drive equipment announced. Table lists various uses and indicates which of four principal types of ac motors should be selected. Specifications, performance ratings and control classes for the required type is readily determined by making corresponding setting on slide.



Information is obtained from selector by setting cardboard slide for the proper motor type and then reading its specifications through the window. Pertinent facts such as horsepower ratings, speeds, voltages, frequencies and starting and pullout torques are thus secured. Reverse side shows which of the various magnetic and manual controls are available for each motor and lists proper control number. *Westinghouse Electric & Mfg Co, East Pittsburgh, Pa.*

Reversing Starters

NEW LINE OF ALTERNATING-CURRENT combination magnetic reversing starters for full-voltage starting and reversing of squirrel-cage induction motors announced. Units also suitable for primary control of wound-rotor motors, and consist of two mechanically interlocked reversing contactors, a 2-pole overload relay, and either a circuit breaker or a fusible or non-fusible motor-circuit switch. Starters provide full-voltage reversing control and short-circuit protection in one unit to save space and installation time, to provide greater protection for equipment and operators, and to improve appearance. Line includes NEMA sizes 0 to 4 starters, covering single- and 3-phase motors

Data on Properties and Working of Free-Machining "KR" Monel

A strong, corrosion-resistant alloy suitable for machining parts which may be hardened by thermal treatment

The new INCO Nickel Alloy, "KR" Monel,* possesses the same combination of properties as "K" Monel.* Equally rustless and resistant to corrosion, it can be hardened by the same treatment to obtain the range of strength, ductility and hardness shown in table below. Like "K" Monel, this alloy is also non-magnetic. However, its machining characteristics are much superior to those of "K" Monel.

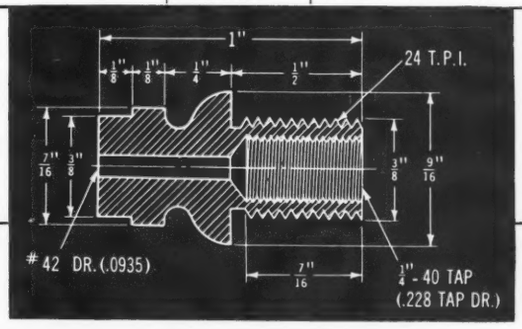
Machining data appear in the sketch and work sheet of operations on a practical job. For more detailed instructions, send for the new, revised edition of Bulletin T-12, "Machining Monel, Nickel and Inconel." Address:

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street **New York, N. Y.**

TABLE OF OPERATIONS

Operation	Rev. Per Min.		Surface Ft. Per Min.	Feed Inches	Remarks
	Spindle	Attachment			
Form	560	....	82	.00025	.....
Box Tool	560	....	82	.003	.....
No. 1 Drill	890	....	54	.002	L.H. Drill
No. 42 Drill	890	1600	60	.0015	L.H. Drill Drilling Attachment
Thread	560	308	25	.0416	Threading Attachment
Tap	560	183	25	.025	Tapping Attachment
Cut Off	560	....	82	.0002	.....

Material—9/16" dia. cold drawn as drawn (not age hardened) "KR" Monel
Machine—No. 2 B & S Automatic Screw Machine
Forward speed of spindle—560 R.P.M.
Backward speed of spindle—890 R.P.M.
Tool—high speed steel (18-4-1 Type)
Cutting lubricant—sulfurized oil



"Monel" and other trade-marks which have an asterisk associated with them are trade-marks of The International Nickel Company, Inc.

MECHANICAL PROPERTIES OF "KR" MONEL

Rods and Bars—Cold Drawn	Tensile Strength 1000 p.s.i.	Yield Strength (0.20% Offset) 1000 p.s.i.	Elongation in 2 in. per cent	Brinell Hardness 3000 kg.
Annealed	90-110	40-60	45-35	140-180
Annealed, age hardened	130-150	90-110	30-20	240-260
As drawn	100-125	70-100	35-15	175-250
As drawn, age hardened	140-170	100-130	30-15	260-320

INCO NICKEL ALLOYS

MONEL • "K" MONEL • "S" MONEL • "R" MONEL • "KR" MONEL • INCONEL • NICKEL • "Z" NICKEL

Sheet . . . Strip . . . Rod . . . Tubing . . . Wire . . . Castings

EXACTING CONTROL

EFFICIENT OPERATION REQUIRES IT—STICKLE VALVES SUPPLY IT—WITH OTHER CONSTRUCTION FEATURES THAT SAVE TIME AND MONEY.

• Stickle Series 400 single seated balanced valves are built to regulate medium and high pressures and for dead end service. Handle high velocities resulting from heavy pressure reductions. Flexible. Maintain constant reduced pressure against variable supply pressure. Leak proof. Do not chatter when working close to seat. Built for steam, air, gas or liquids.

• Eight sizes—¾" to 4". Three types — Lever, Lever and Weight, and Spring Loaded. All internal parts interchangeable. May be repaired at point of use. Main valve and pilot valve and seat reground independently. *Ask for Bulletin No. 435.*

OTHER STICKLE REGULATING AND REDUCING VALVES

• Stickle Series 200, double seated, semi-balanced valves are sensitive, accurate and positive. Proved in years of service as parts of complete automatic control systems maintaining pressures within variations of one-half of one per cent. Small to large pipe sizes. Lever and Weight, Spring Loaded and Pilot-Operated Types. *Ask for Bulletin No. 235.*

The Reliable Stickle

OPEN FLOAT STEAM TRAP

Straight-in-Line Installation

• Easier and more economical installation followed in performance with the high capacity and utter dependability of simple, leverless, hingeless Stickle Open Float Construction with internal air by-pass. Automatic regrinding of valve and seat and other operating advantages. *Ask for Bulletin No. 115.*

Steam Equipment
TO INCREASE PRODUCTION AND SPEED VICTORY

FEED WATER HEATERS & PURIFIERS

• For 35 years leading industries and engineers have chosen Stickle Open Coil Heaters. Larger heating capacity. Greater storage capacity. Negligible maintenance. A size for your purpose. Cast iron or steel. Deaerating or Non-Deaerating. Guaranteed performance. *Ask for Bulletin No. 100.*

DIFFERENTIAL DRAINAGE AND BOILER RETURN SYSTEM

• Usual minimum increase in boiler capacity 15 percent with proportionate fuel saving, plus additional operating economies. *Ask for Bulletin No. 50.*

STICKLE
STEAM SPECIALTIES COMPANY
2265 Valley Avenue, Indianapolis, Indiana

SPECIALIZING FOR 35 YEARS IN REDUCING THE COST OF STEAM

in sizes up to and including 100 hp at 440 or 550 volts. When starters are used with a momentary-contact push-button station, undervoltage protection is provided by an electrical interlock on each contact. *General Electric Co, Schenectady, N. Y.*

Floor Resurfacer

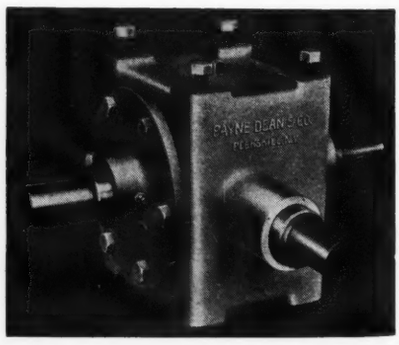
"INSTANT-USE RESURFACER" can be applied to worn floors and used immediately. Said to improve in smoothness and become more compact under constant traffic. Adheres to old concrete or wood, and bonds to a feather edge. *Flexrock Co, 2377 Manning St, Philadelphia, Pa.*

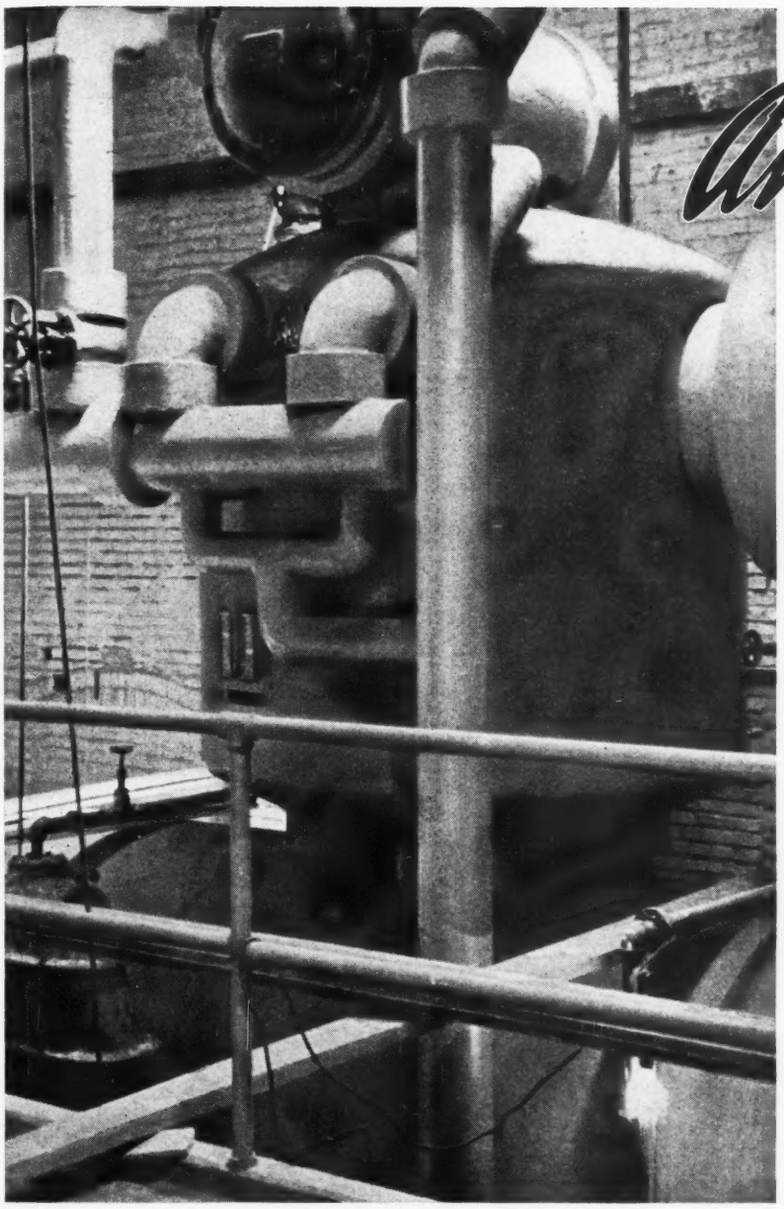
Gyrex Screen

ROBINS GYREX SCREEN has been refined to obtain the utmost in reliability and increase still further expected life of such vital items as bearings, springs and screen cloth. Improved screen now includes such features as: amplified steel to conserve lubricants and to protect bearings against entrance of dirt; shock-absorbing supporting springs to take the impact of live loads; and spring-tension cushion-mounted screen cloth to prevent wire breakage. *Robins Conveying Belt Co, Passaic, N. J.*

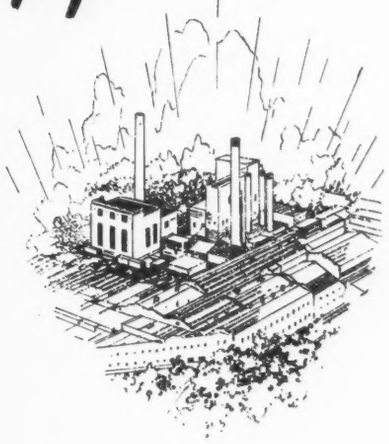
Angle Drive

MITRE GEAR DRIVE with a 1:1 ratio is for changing the direction of any shaft, through an angle of 90 deg. The driving or driven shafts may be set to work in either horizontal or vertical position, for floor, wall or ceiling mounting, a universal base being provided for any such position. Series ADS will transmit 5 hp at 600 rpm, and Series ADH 5 hp at 1200 rpm. Projecting shafts, which are 1¼ in. in diameter may be made any length, although 3 in. is standard. Bearings are bronze, lubricated with Alemite fittings on the slow-speed units,





Another COCHRANE DEAERATOR *in the ranks of the Paper Industry*



238,000 lbs/hr unit at Rhinelander Paper Co.

COCHRANE water conditioning equipment has a brilliant record in the paper industry. Where so much of the process depends on water, its purification both for steam generation and for process work is mighty important.

The recent addition of a new 5000 kva turbine-generator and a 100,000 lbs/hr boiler to the power plant of the Rhinelander Paper Co. at Rhinelander, Wis., illustrates this point.

The feedwater of the new boiler is chiefly returned condensate, make-up averaging about 25%, this being raw river water, sand-filtered and treated.

A Cochrane Deaerator of 238,000 lbs/hr capacity, raises the feedwater temperature to 235°F and reduces the oxygen content to zero cc/1. From here the water enters the economizers at 235°F and is raised to 400°-420°F before entering the boilers.

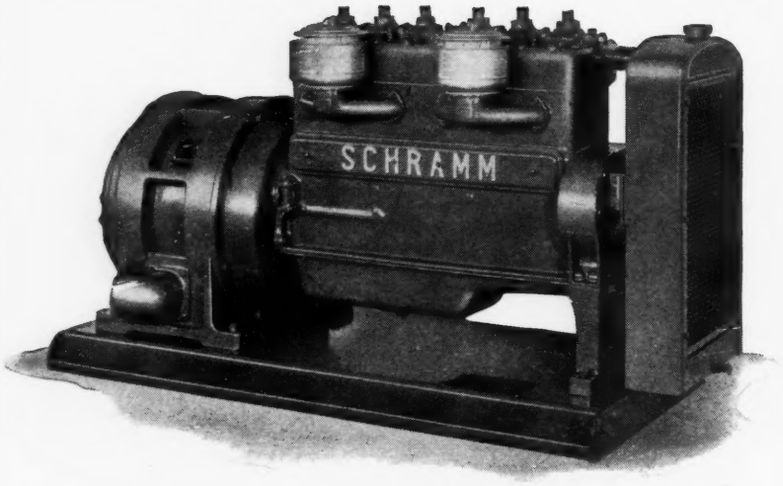
Many of the greatest names in the pulp and paper industry are numbered among Cochrane's customers. A complete list of installations will be sent on request as well as a copy of Publication No. 3005 describing Cochrane Deaerators for all industries.

Cochrane Corporation

3106 N. 17TH STREET PHILADELPHIA, PA.

WATER SOFTENERS • DEAERATING HEATERS • FILTERS • BLOW DOWN EQUIPMENT • VALVES • FLOW METERS

AIR for VICTORY



MODEL #210 COMPRESSOR DIRECT MOTOR DRIVE

Precious minutes in America's VICTORY program are saved each day with SCHRAMM Air Compressors.

In all factories from coast to coast, combinations of SCHRAMM Compressed AIR POWER are contributing to the expanding flow of planes, ships, tanks and guns, in a tremendous effort to emerge VICTORIOUS in this battle to make the "WORLD SAFE FOR DEMOCRACY."

SCHRAMM INC. is building these combinations of compressed air power for operating all kinds of air tools needed for aircraft factories, airports, ship yards, training camps, naval bases, dry docks, power plants and every other important industries.

Time is essential and every weapon made today is worth ten next year. Industries are speeding their production up to maximum capacity—more air is needed for expansion and protection against interrupted power service.

Makes no difference if air requirements are in the shop or out in the yards, or where extension of air lines would be impractical and expensive—SCHRAMM Compressors with their superior performance will give you "AIR WHERE YOU NEED IT," instantly —at low cost.

BUILT IN SIZES 20 TO 600 CU. FT. DISPLACEMENT

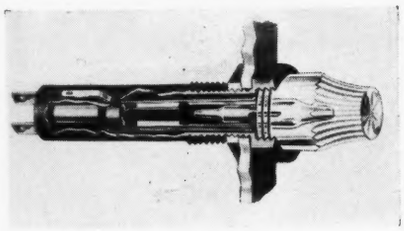
Write For Catalog 42-S

SCHRAMM, INC., WEST CHESTER, PA.

and anti-friction ball or roller bearings on the high-speed series. Delivery can be made on priority of A-10 or better. *Payne-Dean, Peekskill, N.Y.*

Indicator Light

LITTELFUSE INDICATOR LIGHT No. 1414, when installed in any convenient or desirable point in connection with a remote motor control, works instantly, with a plainly visible signal to show on or off. When the circuit breaker opens



the light goes on. Can be obtained for 24- or 48-volt filament bulb, with which no resistor is used. Otherwise it uses a built-in 200,000-ohm protective resistor, in series with a neon lamp. *Littelfuse, Inc., 4757 Ravenwood Ave, Chicago, Ill.*

Safety Transformer

ACME SAFETY TRANSFORMERS provides for two 32-volt ac extension lines to provide light for workmen who must perform duties under conditions in which explosive gases or vapors exist. Applies to cases where inflammable materials are stored or in process, and where possibility of a high-voltage spark may cause considerable damage. The unit is a compact portable instrument that may be carried about the plant and plugged into any ordinary 110-volt ac circuit. It is heavily insulated throughout, and approved by Underwriters' Laboratories. Mounted in one end of the unit are dual polarized secondary receptacles for two 32-volt ac extension lines, a plug-in for inspection light. *Acme Electric & Mfg Co of Cuba, New York, N.Y.*

Cork Coating

PLASTIC CORK COATING tops dripping from condensation or sweating pipes, walls, ceilings, tanks, etc. NoDrip is spread ¼-in. thick over any metal, concrete, brick, plaster, tile, wood, composition, galvanized or painted surface, corners, angles or corrugated ceilings. Can be painted any color. Product is self-bonding, and no primer is needed except when applied on severe rust con-

● That's one of the reasons it lasts longer and seals better. Because of its exclusive design, little pressure is needed to make a Darling Valve seat tightly. The discs simply roll into place, then the last quarter turn expands two wedges against the discs for the tightest possible seal. To open, the first quarter turn releases the wedge action and up come the discs. And because Darling discs are *fully revolving,* they never seat twice in exactly the same place—wear is even, the valve lasts longer, a perfect seal is maintained throughout life of the valve.

Thousands of valves are ruined every year because their design makes it necessary to force them shut and break them open. Others "freeze" shut and have to be opened by heat which warps parts.

Why not use the valve that for over 40 years has been setting records in a dozen industries for long life and low maintenance cost? In these days when replacements are harder and harder to get, it pays to buy for permanence—buy Darling.

Darling offers you a quality line of longer-lasting Gate Valves. They come in Fully Revolving Parallel Seat Double Disc, also in Taper Seat—Slotted and Solid Wedge types. In service pressures up to 3000 pounds, you can get Darling Gate Valves in Cast Iron, Bronze, Forged Steel, Cast Steel, and Corrosion Resistant Alloys. Darling also manufactures Compression Type Fire Hydrants, Check Valves, Motor and Cylinder Operated Valves, and many accessories.

TRADE DARLING MARK

VALVE & MANUFACTURING CO.
WILLIAMSPORT, PA.

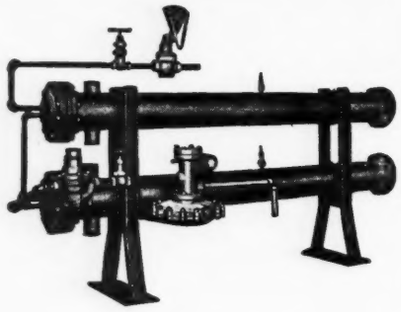
WAR PRODUCTION
demands
CLEAN BOILERS
for the production of
a **STEADY FLOW** of
CLEAN STEAM

HENSZEY
CONTINUOUS BLOWDOWN

can help your equipment bear the weight of war loads!

The Henszey Continuous Blowdown System gives you complete control of boiler water concentration. It automatically blows down a predetermined percentage of the make up water—recovering up to 95% of the heat loss incurred by ordinary intermittent blowdown.

By keeping the boiler water concentration below a predetermined "safe point", priming, foaming and carry over can be eliminated. Combined with simple chemical treatment of the boiler-feed water it also eliminates scale.



Advantages are:

- **Clean Steam**
- **Clean Boilers**
- **Less Boiler Outage**
- **Increased Efficiency**
- **Less Fuel Consumption**
- **Lower Power Costs**
- **Longer Life of Equipment**

Write today for consultation

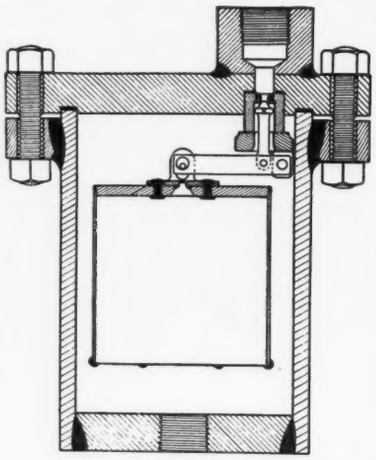
HENSZEY COMPANY
Dept. D5 **Watertown, Wis.**

HENSZEY

ditions, wood, concrete, brick, tile, cement and plaster. Product is non-inflammable while wet and will not propagate fire when dry. *J W Mortell Co, Kankakee, Ill.*

High-Pressure Trap

WELDED STEEL HIGH-PRESSURE TRAP is for draining lines up to 600 psi 750 F. All operating parts are of "Strong" design and construction, including stainless bucket. Anum-Metl valve-seat pins, patented anti-balancing device,

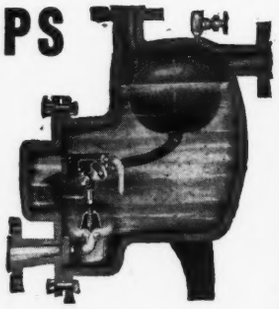


and easily inspected, internal bolted-in seat. Trap body is seamless steel tubing with steel cover. All welds fabricated by certified methods and operators. Each trap is hydrostatically tested at twice rated pressure, plus operating test on steam. *Strong, Carlisle & Hammond Co, Cleveland, Ohio.*

Tri-clad Motors

THREE NEW MOTORS, a vertical general-purpose polyphase motor, a vertical shielded polyphase motor, and a vertical shielded single-phase motor, have been added to Tri-clad line. Shielded motors are suited to pumping applications, and general-purpose motor for the machine tool industry, as well as for agitators, mixers and similar applications. Motors are suitable for outdoor operation except where extremes of moisture, dust or other harmful agents make selection of fan-cooled motors more economical. All frame sizes have common mounting dimensions, making possible interchangeability of many horsepower and speed combinations, including single-phase ratings. Motors can be rotated to any one of four base positions without modification of supporting structure. Polyphase shielded motors available in either solid or hollow shaft construction, while single-

NICHOLSON
Weight-Operated
TRAPS



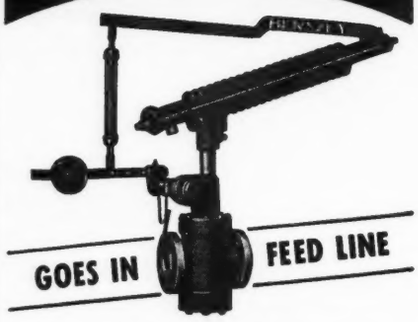
Keep Steam Units at TOP Efficiency

STOPS the costly loss of live steam due to re-evaporation of condensate under super heat conditions . . . valve always wide open or fully closed. Dependable performance and long life assured by quick snap action and non-collapsible float. Built for all pressures up to 1500 lbs. Made in sizes from ½" to 2". Write for catalog No. 941.

W. H. NICHOLSON & CO.
125 OREGON ST., WILKES-BARRE, PA.

Piston and Weight Operated Steam Traps, Industrial Thermostatic Traps, Compressed Air Traps, Floats, Couplings, Valves, etc.

HENSZEY
BOILER FEED
REGULATORS



The Henszey Boiler Feed Regulator controls boiler water levels continuously and accurately under *all* load conditions!

These simple, compact, self-contained units go right in the feed line and require no additional structural support. They are as easy to install as a simple gate or globe valve. Once installed and set for operation no further attention is necessary—nothing to get out of order—nothing to reset.

Send for latest Bulletin containing full details.

HENSZEY COMPANY
Dept. D5—Watertown, Wis.

MULTIPLE V-BELT DRIVE ASS'N

THE DOMINANT DRIVE OF INDUSTRY

TRADE MARK

The use of this emblem by an association member in connection with Multiple V-Belt Drives is your assurance of mechanical excellence — the result of cooperative engineering, research and experience.

horsepower to elephant power .... with multiple v-belt drives

The first commercial Multiple V-Belt Drive, rated at 10 h.p. was put into service early in 1925 and used to drive a cotton twister frame. Encouraged by the success of its operation, larger drives were tried, and, when they likewise proved eminently satisfactory, still larger installations were made. . . . In practically every type of service, it was demonstrated that a Multiple V-Belt Drive would do the job better and more economically. Today, there are Multiple V-Belt Drives delivering 2000 horsepower. And tomorrow? Who can say? Apparently, there is no ceiling beyond that of demand. . . . It is obvious that this popular method of power transmission had to be outstandingly better to become "The Dominant Drive of Industry". And it is likewise obvious, that only by free interchange of engineering research and field findings between members of the Multiple V-Belt Drive Association, that such amazingly swift progress could have been made.

MULTIPLE-V-BELT DRIVE ASSOCIATION
140 SOUTH DEARBORN STREET • CHICAGO

YARWAY
INVOLUTE
SPRAY
NOZZLES

Unique Yarway Involute design.

No internal parts or vanes to clog or erode.

Unobstructed flow gives minimum loss of head.

Finely divided spray cone provides rapid cooling.

Renewable orifices adapt nozzles for any service.

Installations total more than 5 million gallons per minute in water cooling and air conditioning service.

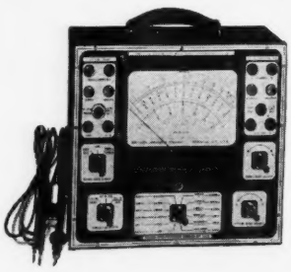
Made in both cast and bar-stock types. All sizes from 1/4 in. to 2 1/2 in. Write for Catalog N-615.

YARNALL-WARING COMPANY
100 Mermaid Ave. Philadelphia

phase shielded motors are available only with solid shafts. Most shielded types are for normal- or high-thrust applications. *General Electric Co, Schenectady, N. Y.*

Multi-Range Tester

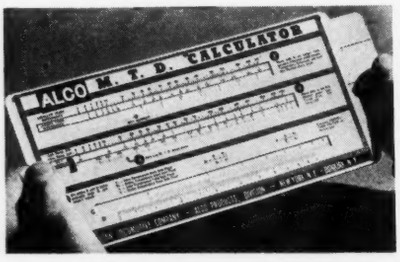
SERIES EV-10 is an electronic measuring instrument which provides full functions of eight individual instruments to satisfy most measurement requirements. Combining both VTVM as



well as standard 1000 ohms per volt ac-dc test circuits, Series EV-10 instrument permits rapid, accurate measurement without materially disturbing performance of the circuit under analysis. *Precision Apparatus Co, 4 Kent Ave, Brooklyn, N. Y.*

Alco MTD Calculator

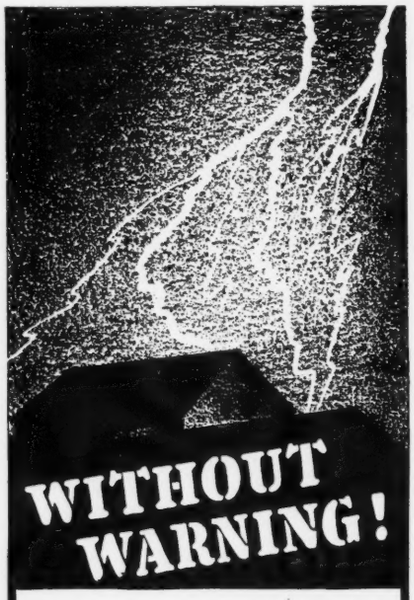
ALCO CALCULATOR HAS BEEN DEVISED to help in the approximation of heat transfer surfaces when preparing estimates or specifications for heat exchange equipment. This calculator in-



cludes scales for the calculation of the logarithmic MTD, as well as the MTD correction factors for 1, 2, 3, 4 and 6 shell passes, and also C and D scales which permit multiplication and division operations. *American Locomotive Co, Alco Products Div, 30 Chuch St., New York, N. Y.*

Fluorescent Lamp Process

PROCESS SAID TO INCREASE life and initial brilliance of fluorescent lamps and eliminate subsequent development of dark, splotches or shadowy end-bands. Basis of new process is explosion of a

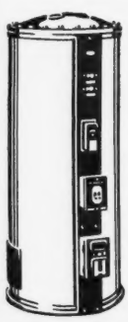


Turbine oil has been known to serve satisfactorily for many years without changing and with very little care; then has failed from no apparent cause, and with slight warning.

Do you know that there are at least five vulnerable points where contaminated oil can strike your turbine?

Do you know that there can be as many as nine different kinds of solid and soluble contaminants in turbine oil?

Do you know that a Honan-Crane *"Continuous"* Oil Purifier will safely remove all nine kinds of contaminants from the oil and protect all vulnerable spots in your turbine?



★

Write for Bulletin 300TP which will give you the complete story on oil purification—what it means to successful turbine operation. Be sure to write today!

HONAN-CRANE CORPORATION
OFFICES IN PRINCIPAL CITIES
LEBANON, INDIANA

ADVANCED IN ENGINEERING AND DESIGN

SAFE · DEPENDABLE · ACCURATE

SHAW PREFABRICATED PIPING

for POWER AND INDUSTRIAL PLANTS

Since 1893, Benjamin F. Shaw Co. has specialized in the prefabrication and installation of safe, accurate, dependable piping for power and industrial plants. Geared for fast, low cost production, we can meet your demands for every type of prefabricated piping. We invite your inquiry.

BENJ. F. SHAW CO.

WILMINGTON · DELAWARE

KILL NOISE TO STEP-UP PRODUCTION

Noise is a handicap to clear thinking. It distracts attention to the task in hand, causes slow-ups, fatigue and, consequently, mistakes. Kill noise and you step-up production, obtain the full benefit of creative thinking, keep minds and hands at work.

MAXIM *Saves . . .*

by efficiently silencing the distracting noises of internal combustion engine exhaust and intake, steam blow-off, and compressor intake . . . and at the same time absorbs air-borne vibration.

MAXIM *Serves . . .*

in power plants, refineries, manufacturing plants, laundries, and in all types of industrial plants where stationary engines and steam installations are at work. Also, Maxim Silencers need practically no maintenance for a long life of trouble free service.

MAXIM *Says . . . .*

Use the attached coupon for full particulars or write us about your problem. Maxim engineers will make exact recommendations for effective silencing.

The Maxim Silencer Co.

92 Homestead Ave., Hartford, Conn.

THE MAXIM SILENCER COMPANY
92 Homestead Ave., Hartford, Conn.

Please send details on your silencers for

EXHAUST ☐ for COMPRESSOR INTAKE ☐
for STEAM BLOW-OFF ☐

Name .....

Company .....

Address .....

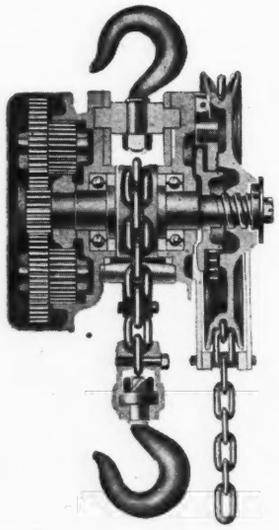
City ..... State .....

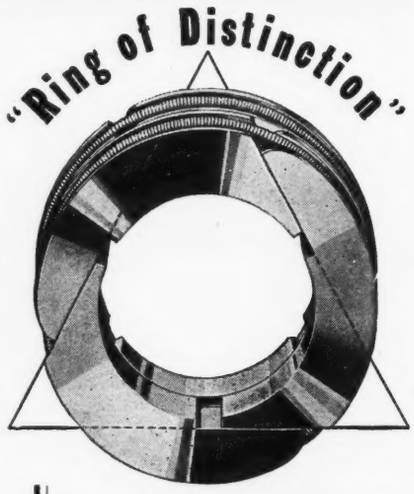
MAXIM SILENCERS

mercury "bomb" in lamp interior during manufacture, regulating exactly amount of mercury in lamp and producing improved performance claimed. Fluorescent lights demand a precise amount of mercury in the tube. Too little mercury causes lamp to slump within a comparatively short time, and an excess fills in the "pores" of the fluorescent coating, eventually causing dark discolorations and blackened end-bands and reducing the lamp's lumen output. Previously the full amount of mercury was deposited just before the tube was sealed by a mechanical device working on the eye-dropper principle. The machine was not completely accurate or dependable, often depositing too much or too little mercury, resulting in many rejects or unsatisfactory performance during use. "Bomb" method makes it practically impossible for a tube to receive an incorrect amount of mercury. This "bomb" consists of a tiny length of mercury-filled nickel tubing spot-welded to the probe of one cathode in the tube. Just before lamp is finally sealed, enough heat is applied to explode the tubing and the mercury is released in the form of a vapor in the argon-filled interior. *Hygrade Sylvania Corp, Salem, Mass.*

Chain Hoist

IMPROVED STANDARD SPUR GEAR chain hoist is equipped with a dust guard to protect Weston brake from dust and dirt. Heavy suspension plates provide unbreakable support between top hook crosshead and load sheave. These plates also support the saddle for double-chain hookup, an entirely new feature in this hoist, and eliminates the use of a top yoke, thus reducing weight and headroom and permitting hoist to hang



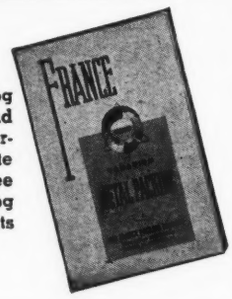


Install FRANCE Metal Packing for "Round-the-Clock" PRODUCTION

The renewal of ordinary packing every few weeks or months increases horsepower and production costs.
Minimum friction is encountered with France Metal "Ring of Distinction" Packing. No undue force can be exerted on rods or stems by tightening the stuffing box stud nuts. The rings are free to float in the case that retains them and are held to the rod or stem with a garter spring having minimum tension.
The result is tight "full-floating", trouble-free performance *for years*. Prompt delivery assured.

FREE

44-page Catalog of useful and valuable information. Write for your free copy of Catalog M-7, with facts on

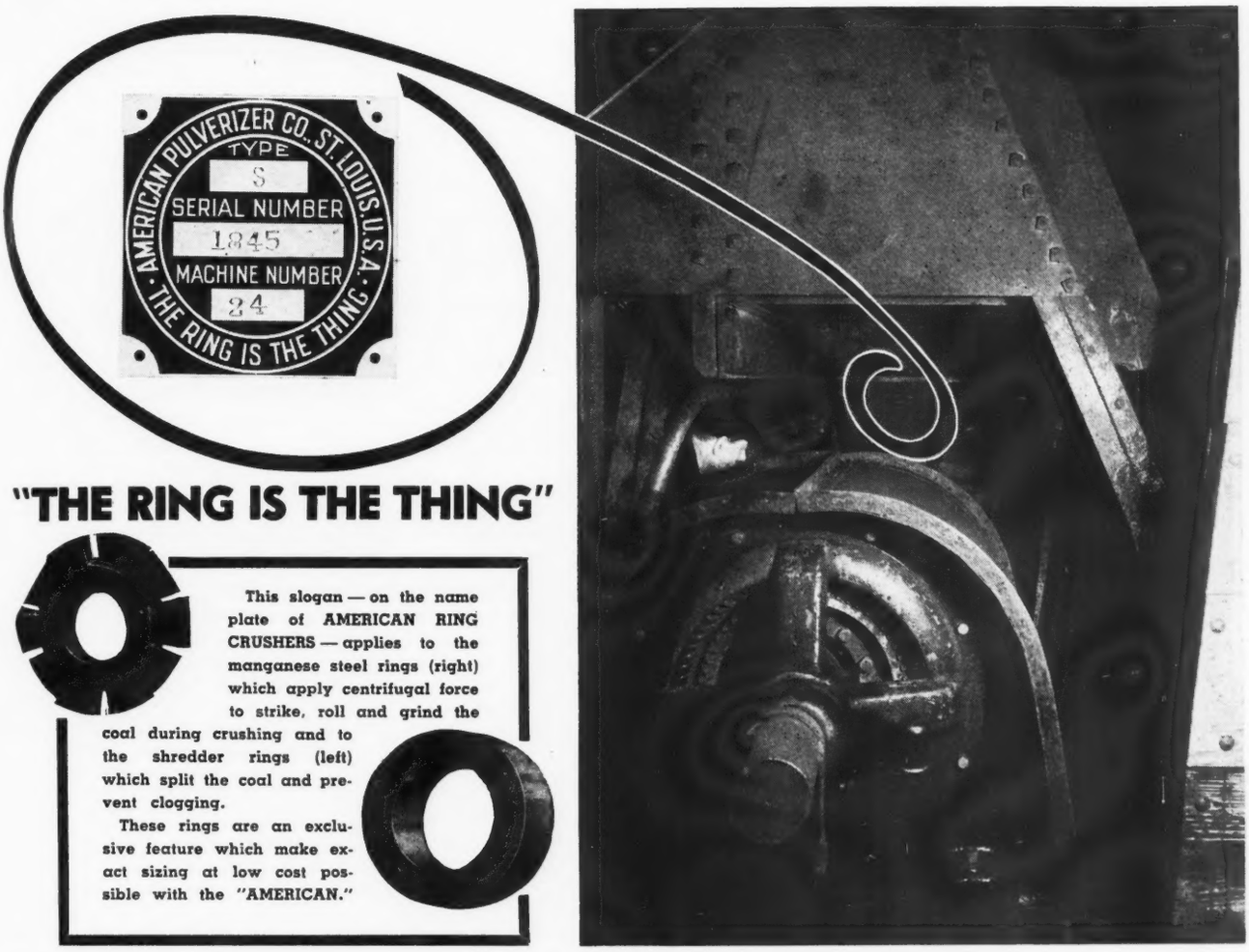


- **Packing Designs for Any Service**
- **Installation Procedure**
- **Methods of Lubrication**
- **Pressures and Temperatures**
- **Oil Return and Stripping Rings**
- **Handy Reference Tables**

Request France Engineers to analyze your packing requirements. There is a representative close at hand.

THE FRANCE PACKING COMPANY
Tacony, Philadelphia, Penna.

***Original* FRANCE METAL PACKING**



"THE RING IS THE THING"

This slogan — on the name plate of AMERICAN RING CRUSHERS — applies to the manganese steel rings (right) which apply centrifugal force to strike, roll and grind the coal during crushing and to the shredder rings (left) which split the coal and prevent clogging.

These rings are an exclusive feature which make exact sizing at low cost possible with the "AMERICAN."

CORN PRODUCTS REFINING COMPANY INSTALLS A SECOND "AMERICAN" TO ASSURE PROPER COAL SIZING

The No. 24S AMERICAN RING CRUSHER shown here replaces an old No. 24 AMERICAN at the Argo, Illinois plant of the Corn Products Refining Company. Good service with the old equipment dictated the choice of the equipment to replace it. This new "AMERICAN" has a capacity for handling 100 tons of 18" run of mine coal per hour, crushing it to ¾" and finer. It is ruggedly built for long, hard exacting service. A simple adjustment provides for sizing the coal to any particular requirements.

Experience in the many plants using "AMERICANS" for sizing coal points to a very low cost for both crushing and for maintenance as well as worthwhile savings in fuel. On the average, "AMERICAN RING CRUSHERS" size coal for less than .01¢ per ton (for all charges) and reduce fuel bills from 2½ to 8%.

It will be to your advantage to get all facts pertaining to the "AMERICAN" way to size coal for savings and overall plant efficiency. The coupon below provides a convenient way for you to ask for details. Fill it out and mail it today.

AMERICAN PULVERIZER COMPANY

ORIGINATORS AND MANUFACTURERS OF RING CRUSHERS AND PULVERIZERS
1349 MACKLIND AVE. ST. LOUIS, MISSOURI

AMERICAN PULVERIZER CO., 1349 Macklind Ave., St. Louis, Mo.

Gentlemen:
Kindly send me (with obligation) a copy of your NEW Bulletin "Crushing Coal At Less Than One Cent Per Ton."

Name.....

Position.....

Company.....

City.....

MAIL COUPON FOR NEW BULLETIN

"BRICKSEAL" YOUR REFRACTORY LININGS

TRY THIS temperature-resisting armor plate—and minimize shutdowns

BRICKSEAL is the solution to the problem of frequent shutdowns caused by breakdowns in refractory linings. BRICKSEAL is the answer because it forms a highly glazed semi-plastic armor plate surface over the refractories and is impervious to temperature changes.

BRICKSEAL—a combination of high fusion clays and metals combined in oils—is available for all temperature conditions and is easily applied either by air spray or hand brush. It is unaffected by acids, alkalies or gases and will not crack, peel or blister. It provides a rugged binder for cracked and loosened fire brick as well as protection against clinkering, slagging or spalling. In furnaces fired with fuel oil, BRICKSEAL prevents absorption of any unignited oil by the refractories.

BRICKSEAL is being used today in practically every type of boiler and under all types of firing conditions—for new walls as well as for refractory maintenance.

Write today for full and complete information. It will pay you to have a BRICKSEAL man call.

DESIRABLE TERRITORIES AVAILABLE

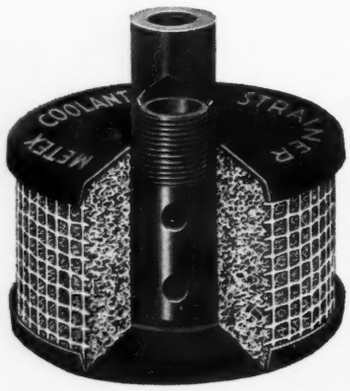
Openings for sales representatives are available in certain desirable territories. Investigate!

BRICKSEAL REFRACTORY CO.
1029 CLINTON ST.
HOBOKEN, N. J.

evenly at all times. New model embodies many other features and is built in six capacities from ½ to 4 tons. *Coffing Hoist Co, Danville, Ill.*

Coolant Strainer

STRAINER ON ALL COOLANT SYSTEM machines will strain metal chips and cuttings remaining in suspension, permitting only chip-free cooling solution to pass through pump. Saves general wear and tear on pumps and oil. Shop practice reveals that on "dirty work" machines will operate without interruption four to six weeks. Cleaner work will permit efficient production functioning for longer period. Refills are easily installed in a few minutes. For large coolant tanks, strainers may be "ganged" on a larger intake line. *Metal Textile Corp, Orange, N. J.*



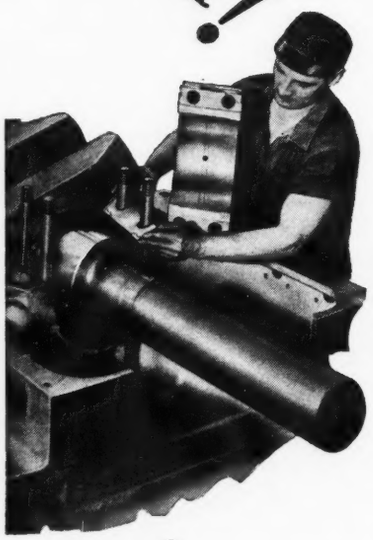
Builder's Plastic

WET-X-HALE builder's plastic was fully described on page 146 of April POWER. The item failed to state that the most important feature of the material was that it could be applied directly to rusty steel surfaces without a primer. Typical installations for test purposes have been made in New York and the Company invites inspection. *Rogear Co, 11 Water St, New York. N. Y.*

Butterfly Valve

SOLENOID-OPERATED valve provides 2-position control—either automatic opening or wedge-tight shutoff in case electric power fails or is turned off. In an open position butterfly vane is held open by magnetic solenoid action. When electric power is shut off trigger is tripped and counterweight closes butterfly vane by gravity, wedge-tight against valve body. In case of fire, due to incendiary bombing, for instance, the

pressure-proof!



CONSERVE machine efficiency! *Babbitt-tipped* Laminum shims, for pressure-lubricated systems, prevent oil and pressure losses. Body of shim retains all Laminum features of quick precision adjustment by *peeling* . . . in factory assembly or field service.

The .003 or .002 in. laminations are bonded into a solid unit . . . easy to peel.

Laminum shims are cut to your specifications. For repairs or maintenance, get stock shim materials from mill supply dealers. (Write us for illustrated shim application file-folder and Laminum sample.)

Laminated Shim Company
Incorporated
61 Union Street Glenbrook, Conn.

it's LAMINUM
THE SOLID SHIM THAT *peels* FOR ADJUSTMENT

Take those tube curves fast!

Make an Elliott-Lagonda job of cleaning your curved tubes — that means a speedy job, and thorough too. There's a lot more to cleaning those short-radius curved tubes than just getting around the bends — you have to clean 'em too, at the same time! You have to use a cleaner that cannot only squirm its way through bend after bend, but that can put the "bite" on the toughest scale while doing it.

It takes an Elliott-Lagonda to do this double-barreled job, and it has taken a good many years of knowing how, to make the cleaner that will do it fast and well. Those years are working for you, when you use an Elliott-Lagonda.

There is plenty of experience on tap for you at "Tube Cleaning Headquarters." When the going gets tough, check with us. We can probably help. Write.

ELLIOTT COMPANY

LAGONDA-LIBERTY Tube Cleaner Dept.

SPRINGFIELD, OHIO

DISTRICT OFFICES IN PRINCIPAL CITIES

Y-180

FUEL CONSERVATION BEGINS

HERE!

Cut waste with Ranarex* CO_2 INDICATOR and RECORDER

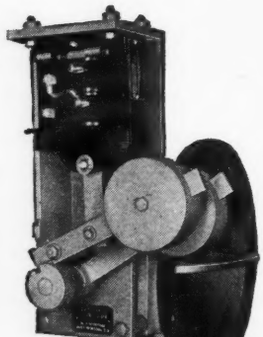
Instant, accurate CO_2 readings insure firing efficiency, save precious fuel. This sturdy instrument will stand up under the severe strains of war production, too, because it's fully mechanical—there are no chemicals or fragile parts.

FREE BOOKLET from The Permutit Company, Dept. A. 330 West 42nd Street, New York, N. Y. In Canada: Permutit Company of Canada, Ltd. . . . Montreal . . . Toronto . . . Winnipeg . . . Calgary.

*Trademark Reg. U. S. Pat. Off.

product of

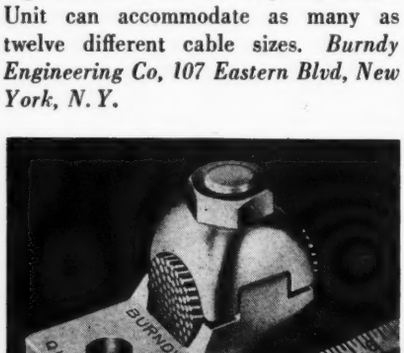
PERMUTIT



valve in a gas or chemical line would be set for automatic closing. Should explosive or poisonous gases escape, automatic closing of an air-pressure line would minimize danger of personal injury or property damage. Valve can be constructed of any metal alloy in various sizes for air, gas, steam, oil, hydraulic and other services. *R-S Products Corp, 4530 Germantown Ave, Philadelphia, Pa.*

Terminal Connector

QIKLUG CONNECTOR TAKES a wide range of conductor sizes, is compact and provided with serrations on cable clamping elements on all but very small sizes. Unit can accommodate as many as twelve different cable sizes. *Burndy Engineering Co, 107 Eastern Blvd, New York, N. Y.*



Condensate Sampler

DEVICE PROVIDES ACCURATE MEANS of sampling condensate for a conductivity cell which in turn connects electrically with a suitable measuring or checking instrument calibrated in direct-reading terms such as percentage of carry-over or soluble salts. Conductivity cell holder is available alone for use with any type of condensate cooler or in combination with a new type cooler recently made available. Cell holder admits condensate or cooled boiler water through

PALMETTO PETE says

PALMETTO* PACKING STAYS SOFT 3 times longer

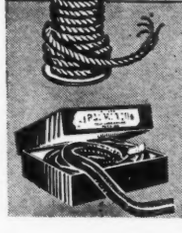
Why? . . . because of its *internal* lubricant, impregnated in each individual strand *before* braiding or twisting. This graphite lubricant, specially selected for use in Palmetto, continuously works its way to the outer strands to replace the lubricant lost through wear, and keeps Palmetto soft far longer than ordinary packings.

Free WORKING SAMPLE

Prove the lasting softness of Palmetto at our expense. Just send us your name and address, stating the service for the packing and its size, and a generous sample will be sent you without charge or obligation.

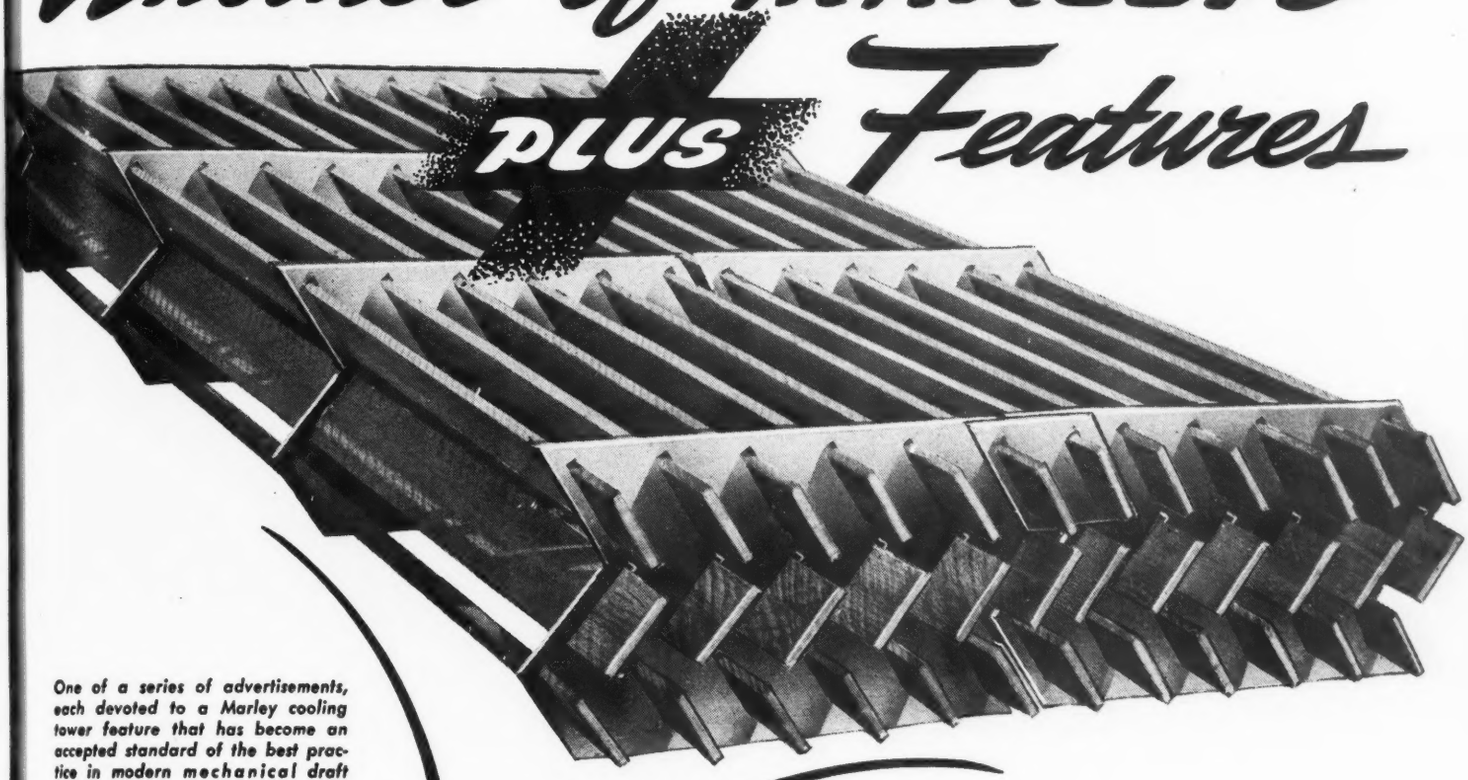
*Reg. U. S. Pat. Off.

GREENE, TWEED & COMPANY
Bronx Blvd. at 238th Street
New York N. Y.

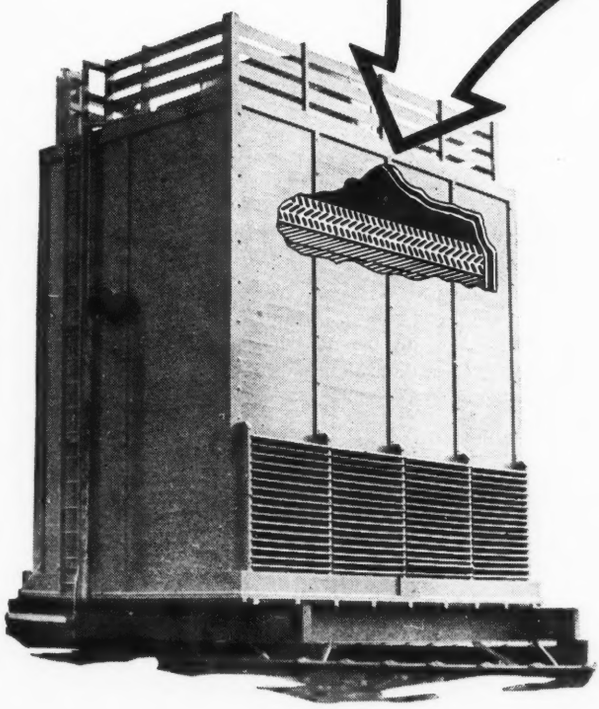


PALMETTO
for steam, hot water, air.
PALCO *for water.* PELRO *for oils.* CUTNO *for alkalis.*
SUPERCUTNO *for acids.*
KLERO *for foods, etc.* PALMETTO SUPERSHEAT
PACKINGS

Another of MARLEY'S PLUS Features



One of a series of advertisements, each devoted to a Marley cooling tower feature that has become an accepted standard of the best practice in modern mechanical draft water cooling.



MARLEY'S patented **Drift Eliminator,** of which the above is one section or "bundle," permits less than a tenth of one percent of "drift" moisture to escape from Marley Mechanical Draft Cooling Towers.

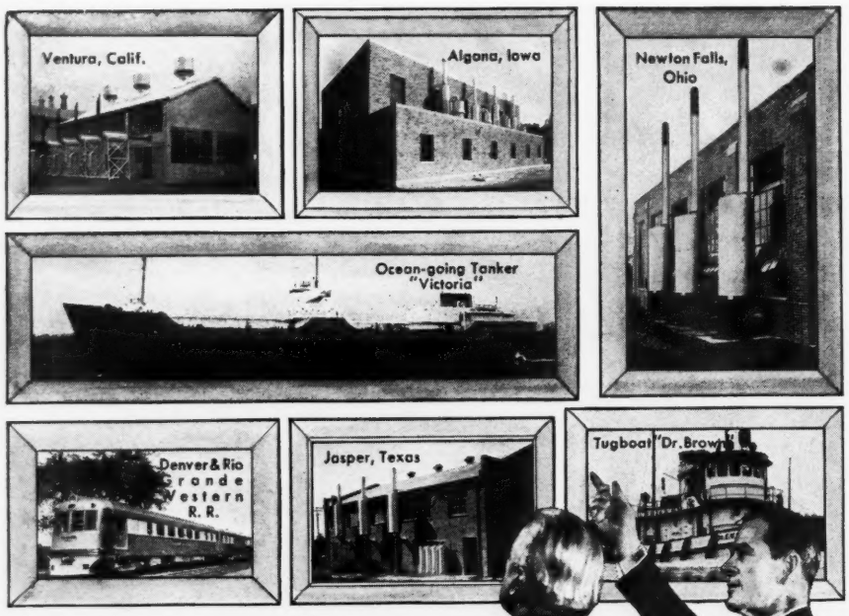
Its freedom from maintenance troubles is due to ingenuity both in design and materials. Frames of *Presite* composition are slotted to receive Redwood blades, making up easily-handled "bundles" without nails, bolts or other rigid fastenings. No metal parts to corrode or break! Blades are held in precise spacing and alignment yet are free to expand and contract without warping or stress. No snapped blades or twisted sections!

This triple-effect zig-zag design pioneered by Marley more than ten years ago has become the recognized optimum for *maximum moisture-stoppage* with *minimum resistance to air flow*. That has meant total absence of drift nuisance and considerable savings on fan power to owners of the many hundreds of Marley mechanical draft towers in which nearly two million square feet of these eliminators are installed.

The Marley Drift Eliminator is just one of the many exclusive features which account for so many *more* cooling towers bearing the Marley name.

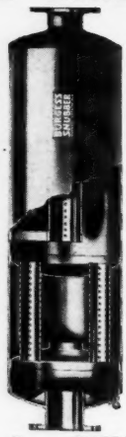
MARLEY COOLING TOWERS

MARLEY TOWER *is individually engineered by* THE MARLEY CO., INC. — KANSAS CITY, KANSAS



Wherever you look
these Snubbers are providing
QUIET DIESEL EXHAUSTS

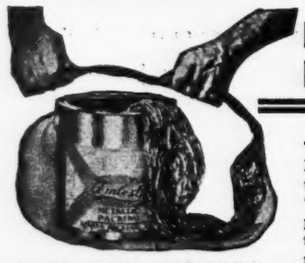
Diesel engines are now running in all types of plants without objectionable exhaust noise. Hundreds of installations, like those pictured above, are operating in critical locations without exhaust noise complaints. Why? Because these Diesel engines are quieted with Burgess Exhaust Snubbers . . . and there is no interference with efficient engine operation.



Burgess SDHC Series Snubber.

The Burgess snubbing principle removes the source of exhaust noise before the noise can occur. That is why a Burgess Snubber is different in design and performance from ordinary mufflers. For further information about this new method of quieting Diesel exhausts, write Acoustic Division, Burgess Battery Company, 2823-L W. Roscoe St., Chicago, Ill.

BURGESS SNUBBERS



Put "AMBEST" to a long life test on any tough job

WRITE FOR WORKING SAMPLE Eureka offers Flax, Asbestos, Rubber and Metallic Packings for all purposes. Send for 36 page catalog.

This UNIVERSAL packing—of long, pliable, anti-friction metallic alloy strands—assures low cost, long life packing protection and easy application on any rod in good condition. "AMBEST"—available for all pressures and temperatures up to 550° F.—is recommended for pumps, compressors, engines, throttles and valve stems. *All* needs are supplied by one packing when you use "AMBEST."

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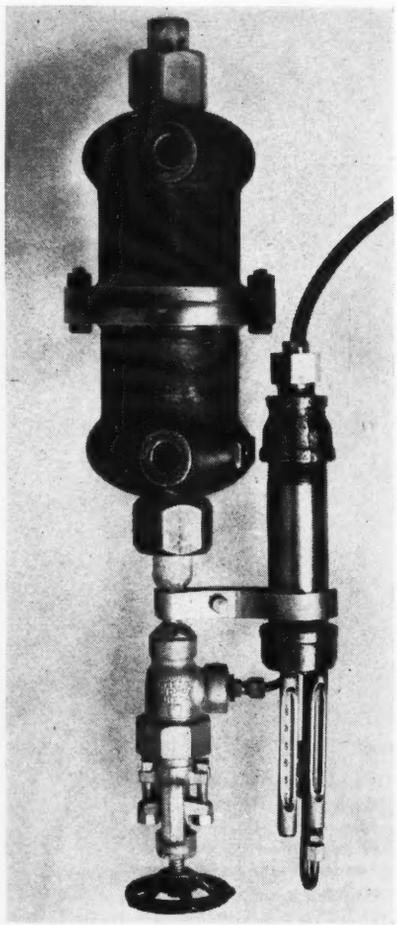
EUREKA PACKING CO., 294-296 46th St., BROOKLYN, N. Y.

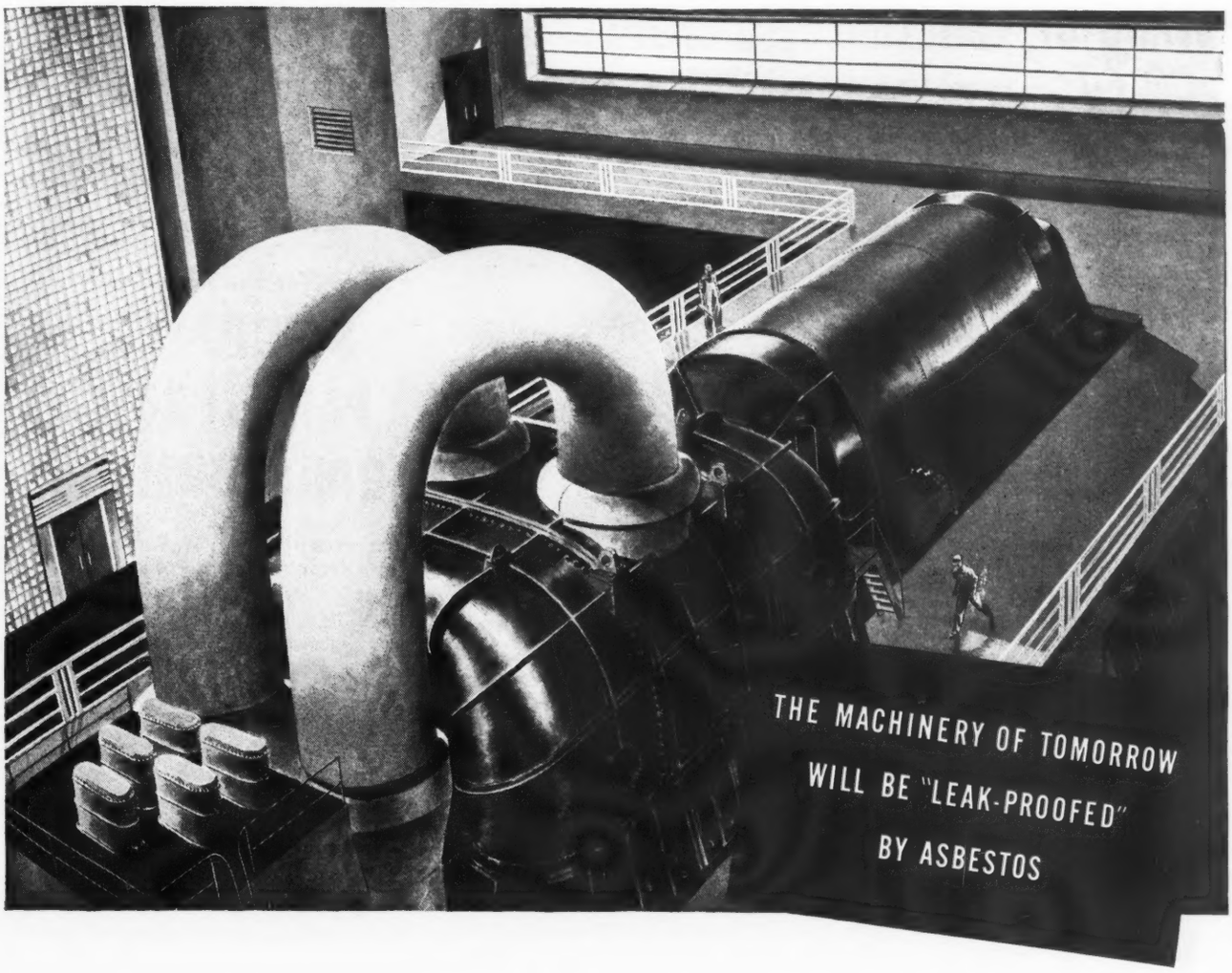


its ¼-in. solderless pressure-connected copper pipe. An outlet pipe with a 2-way control cock releases condensate to drain pipe. Neoprene baffle within sampler chamber insures proper circulation of condensate past conductivity cell screwed in chamber bottom. Thermometer indicates condensate temperature, a vital factor in accurate electrical-conductivity reading. Sight gage indicates presence of oil, which can be drained off by turning the drain cock to the oil-drainage position, safeguarding conductivity cell against contamination. Cell holder may be connected with any suitable condenser. Combination is arranged for easy installation with a minimum of elaborate mounting or plumbing. *Industrial Instruments, Inc 156 Culver Ave, Jersey City, N. J.*

Floor Resurfacer

RESURFACER CAN BE INSTALLED without any interruption to floor traffic, and can be used immediately. It is a ready-mixed plastic material that is rolled or tamped into a hard surface. Product bonds to oily floors and is highly resistant to oils and other destructive materials. Can be applied directly to old concrete, steel, stone, wood or brick floors, walks or drives. *Flush-Stone Co, Inc, Philadelphia, Pa.*

Looking ahead with Asbestos



It is hard for the industrial engineer to imagine a better base for high temperature packings than asbestos.

For, wherever he looks now, he sees asbestos packings—either pure or in combination with a variety of other materials—keeping liquids and gases in their place in every sort of machine. K&M Packings, based on asbestos, dive with the submarine, soar with the airplane, do their super-efficient leak-proofing on every industrial front.

The peace-time record of K&M Packings foretells their still more extensive use, once the demands of war subside. Meanwhile, in our research laboratories we continue the search for new and vital uses for asbestos; and we invite you to suggest how we might adapt this versatile mineral to your greater service.

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New Power Construction

Construction to Come

Arizona-California—Bids Apr 23, by Bureau Reclamation, Customhouse, Denver, Colo., furnishing fabricated structural steel for Structures 1 to 19 (inclusive), station-service bus structure, miscellaneous equip. Phoenix substation, Parker Dam power project, Spec 1624-D.

Arizona-California-Nevada — Bids Apr 27, by Bureau Reclamation, Customhouse, Denver, furnishing two motor driven pump units, control equip for installation in No 4 drain pump plant, Reservation Div of Yuma Proj, part of All-American canal sys. Boulder Canyon project, Spec 1626-D.

Arizona and Nevada—Bureau Reclamation, Customhouse, Denver, Colo., receiving bids constructing Davis Dam and power plant, 28 mi above Needles, on Colorado River. $41,200,000.

Arizona and Nevada—Bids Apr 29, by Bureau Reclamation, Customhouse, Denver, Colo., furnishing four single-phase, oil-immersed, self-cooled out-door transformers, station lightning arrester, disconnecting switch, outdoor metering equip with meter cabinet and accessories, for Davis Dam construction sub-station. Spec 1623-D.

Arizona and Nevada—Bids May 26, by Bureau Reclamation, Customhouse, Denver, Colo., furnishing five 45,000 kva AC generators for Davis Power Plant, Davis Dam Project, Spec 1034.

Arizona and Nevada—Bids May 25, by Bureau Reclamation, Customhouse, Denver, Colo., furnishing five hydraulic turbines, governors, pump equip for regulating speed of 62,200 hp turbines, in Davis Power plant, Davis Dam Project. Spec 1033.

Ark., Stamps—Arkansas Power & Light Co, Simmons Natl Bldg, Pine Bluff, plans constructing generating plant, $3,000,000.

California—Bids Apr 27, by Bureau Reclamation, Customhouse, Denver, Colo., furnishing 10 circuit breakers, 14 disconnecting switches. Keswick power plant, Spec 1029.

Calif., Stockton—Electric Planing Mill, 545 S Monroe St, plans rebuilding plant, Hazelton Ave and Monroe St destroyed by fire. Loss $65,000.

Conn., Cos Cob—New York, New Haven & Hartford R R, E E Oviatt, ch engr, Water St, New Haven, making sketches constructing brick, steel, concrete power plant imprvs $500,000.

Conn., New Britain—Bd Water Comrs, City Hall, plans constructing watermain exten, cover high service reservoir, power plant, Dockett Conn. 6-165. $750,000 FWA. G Molleur, City engr.

Del., Wilmington—War Dept, 20 St and Constitution Ave NW, Wash., D. C., plans constructing manufacturing plant. Location not revealed. Atlas Powder Co, Delaware Trust Bldg, will operate. To exceed $5,000,000.

Georgia—War Dept, 20 St and Constitution Ave, N W, Wash., D. C., plans constructing plant, $30,000,000. Industrial co will operate. Robert & Co, Bona Allen Bldg, Atlanta, engrs.

Idaho, Mountain Home—Bids May 20, by Bureau Reclamation, Wash., D. C., furnishing two hydraulic turbines, two oil-pressure actuator governors, generators, for Anderson Ranch Power Plant, Boise Project, Spec 1036.

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For Example:

STRIPPING PAINT FROM TRANSFORMERS

The next time you strip paint from transformers, do it faster, easier . . . without laborious hand scraping or "chipping" . . . as so many power plants and public service companies do! Use the successful, low-cost Oakite Hot Flow-on Method.

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"We started our Diesels out right – lubricated with GULF PARVIS OIL."

Says this municipal light plant Superintendent

"And here's the operating record:
No repairs, no stuck rings, and remarkably low lubricant consumption."

Actual photo of Superintendent showing a Gulf engineer what fine results have been obtained with Gulf Parvis Oil in this municipal light plant.

"GULF Parvis Oil is making an outstanding record of performance in our plant" says this municipal light plant Superintendent. "By lubricating these Diesels right from the start with this quality oil, we have avoided repairs and stuck rings, and have secured remarkably low lubricant consumption—in fact, one-third lower than we expected in the light of our experience with other Diesel engines and other lubricants."

Here's one important reason why you can expect better results with Gulf Parvis Oil in your Diesels: Gulf Parvis is specially refined to withstand high temperatures, contamination with fuel and moisture, and constant churning in the presence of air. Thus it retains its high lubricating value for longer periods of time and provides better protection for cylinders, pistons, and bearings—with lower consumption in many instances.

This higher quality Diesel lubricating oil—and the more than 400 other quality lubricants in the Gulf line—are quickly available to you through 1,200 warehouses located in 30 states from Maine to New Mexico. Write or 'phone your nearest Gulf office today.

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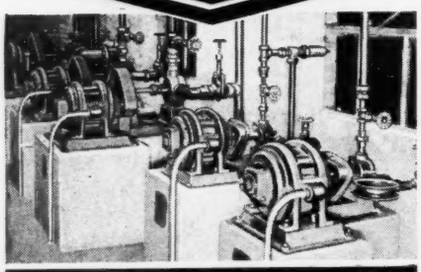

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The Viking Service Manual is offered to you FREE to help you get utmost delivery from your Viking Rotary Pumps. It gives you information on correct installation, how to avoid repairs and replacements. Write for your copy today.

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CEDAR FALLS, IOWA

Ill., Chicago—War Dept, 20 St and Constitution Ave, N W, Wash., D. C., plans constructing manufacturing plant. Location not revealed. Quaker Oats Corp, 141 W Jackson St, will operate. To exceed $5,000,000.

Ill., East Moline—A Niehaus, city clk, plans constructing imprv WW, increasing capacity reservoir by 1 mg, well, pump, pump house, exten mains. $100,000.

Indiana—U. S. Eng, 612 Federal Bldg, P O Box 59, Louisville, Ky., plans constructing mfg. plant. Over $5,000,000.

Indiana—Yards & Docks, Navy Dept, 18 St and Constitution Ave, N W, Wash., D. C., plans constructing improvements.

Iowa—Industrial company plans constructing addnl factory bldgs. Over $5,000,000. U. S. Eng, Arsenal, Rock Island, Ill. will supervise.

Iowa—U. S. Eng, 1709 Jackson St, Omaha, Neb., plans constructing improvements, $10,000,000. Buel & Winter Eng Co, 508 Insurance Exch Bldg, Sioux City, engrs.

Iowa, Keokuk—Keokuk Electrio Metals Co, Keokuk, bids soon constructing superstructure power house. Est $650,000 incl equip Nemmers & Clark, Hubbell Bldg, Des Moines, engrs.

Iowa, Murray—Bids Apr 6, by H K Eden, town clk, constructing electric light and power plant, also dist sys $80,000. R W Gearhart, 349 21 St S E, Cedar Rapids, eng.

Iowa, Muscatine—Bids Apr 14, by Municipal Bd Water & Light Trustees, H Zeug, secy, constructing power plant imprvs Sect 10, bldg work equip fdns, Sect 11, mechanical work, piping, Sect 12, electrical work; Sect 13 emergency generating unit. Stanley Eng Co, Central State Bank Bldg, Muscatine, engrs.

Kansas—Bids after Apr 1, by U. S. Eng, 601 Davidson Bldg, Kansas City, Mo., constructing improvements. $10,000. Gentry, Voskamp & Radotinsky, 312 Commercial Natl Bank Bldg, Kansas City, Mo., archts.

Louisiana—Defense Plant Corp, 811 Vermont Ave N W, Wash., D. C., plans constructing plant. Premier Petroleum Co, Longview, Tex., operators.

Louisiana — Industrial company plans improvements. Weil & Moses, 427 S Peters St, New Orleans, La., engrs. Maritime Comn, 14 St between E St and Constitution Ave, N W, Wash., D. C., will finance.

Louisiana — Industrial company plans constructing plant. $3,225,000. Defense Plant Corp will finance.

Louisiana—War Dept, 20 St and Constitution Ave, N W, Wash., D. C., plans constructing plant. $15,000,000. Industrial company will operate.

Mass., Hingham—Bethlehem Steel Shipbuilding Corp, Hingham, plans constructing sewage treatment sys, sewers, standpipe, 6 pump stations. $800,000. Federally financed. H E Bailey, 177 State St, Boston, engr.

Mich., Detroit—Vinco Corp, 9111 Schaefer Rd, plans constructing bldg expansion. $995,000. Defense Plant Corp will finance.

Mich., Fremont—Gerber Products Co plans constructing 93x209 ft cold-storage plant, also 119x200 ft, warehouse addn.

Minnesota—U. S. Eng, 1217 U. S. Post Office and Customhouse, St. Paul, plans by Smith, Hinchman & Grylls, Inc, 800 Marquette Bldg, Detroit, Mich., and Toltz, King & Day, Inc, 1509 Pioneer Bldg, St. Paul, constructing additional facilities manufacturing plant.

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Each intersection ,and consequently, each complete panel of Batesgrates, is strictly one piece. Non-slip, sharp top edge, self cleaning cross bars like the ridge of a roof. No cracks, joints, or acute angles. No grooves to hold grease and dirt and create slippery spots. Batesgrates are an engineered assembly of bars — all bars work.

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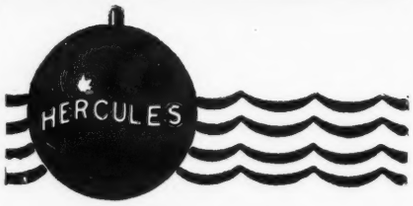

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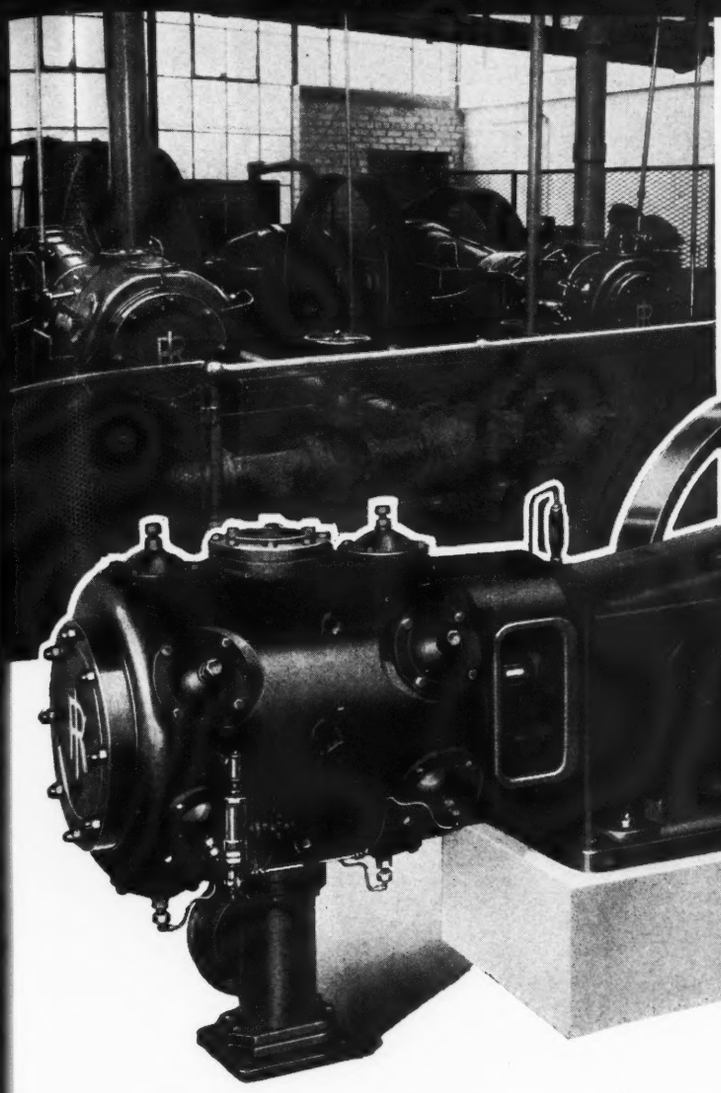

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A heavy-duty single-stage Class ES Compressor equipped with V-belt drive from an induction motor.

BUSY SHOPS DESERVE HEAVY-DUTY COMPRESSORS

Peak plant performance and 'round-the-clock operation provide problems enough without added worry and annoyance due to worn-out or inadequate equipment.

It will pay you to put your trust in efficient heavy-duty machines, such as Ingersoll-Rand's horizontal double-acting Class ES Compressor. Built in 5 to 125 hp sizes, this unit is designed throughout for long periods of uninterrupted, full-load service.

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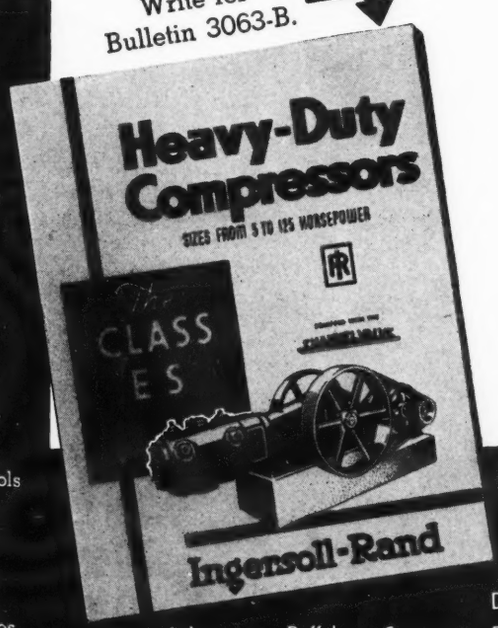

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Aiding the flow of power needed to sustain production is a large army of Ludlow Valves —many of them installed years ago—in the boiler rooms and basements of vital manufacturing centers. Operating on the famous double-disc, parallel seat principle, developed and perfected by Ludlow, these rugged valves work smoothly, close securely — whether in action every few minutes or only in emergencies. In peace or war, *Ludlow means value in valves.* Write for Catalog.

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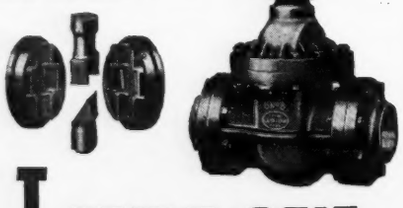
Construction Features: Self-releasing 30° angle wedges and free-floating gates, self-adjusting to seats, afford smooth, trouble-free performance, long service. Rings are cleaned throughout stroke action. Gates are wedge-locked directly opposite ports and completely unwedged before raising. Ample tolerances provide easy action. Simple construction permits easy replacement of parts.



LUDLOW VALVES
SINCE 1866

Mississippi—U. S. Eng, Courthouse and Custom House, Mobile, Ala., plans constructing mfg plant. To exceed $5,000,000.

Missouri—Industrial company will operate plant, for War Dept, 20 St and Constitution Ave N W, Wash., D. C. Defense Plant Corp will finance; $3,500,000 for land and bldgs, $7,943,000 for machinery.

Mo., St. Louis—City, c/o C H Ellaby, pres, Bd P Serv, 304 City Hall, plans imprv WW sys, new boiler room, boilers, $750,000; also underwater coal storage facilities, $75,000. Chain of Rocks Plant, Mississippi River; 40 mg to 60 mg turbine, Howard Bend Plant, Missouri River. $300,000.

Nebraska—U. S. Eng, 1709 Jackson St, Omaha, plans constructing plant. $75,000,000.

Neb., Republican City—U. S. Eng, 1709 Jackson St, Omaha, plans constructing Harlan County Dam, near here. $7,000,000.

New York—Industrial company plans constructing aluminum plant. Defense Plant Corp will finance.

New York—War Dept, 20 St and Constitution Ave N W, Wash., D. C., plans constructing plant. $1,000,000. Industrial company will operate. Defense Plant Corp will finance. Lockwood Greene Engineers, Inc, 30 Rockefeller Plaza, New York, engrs.

N. Y., Syracuse—Bids Apr 29, by Comr Mental Hygiene, State Office Bldg, Albany, constructing boiler room addn Boiler House Bldg & Syracuse State School. $114,000.

Ohio—Industrial company plans constructing plant expansion. $18,000,000. Defense Plant Corp will finance.

Ohio—U. S. Eng, 232 N High St, Columbus, plans constructing plant. To exceed $5,000,000.

Ohio—U. S. Eng, 232 N High St, Columbus, plans constructing plant. To exceed $5,000,000. Industrial company will operate.

Ohio, Warren—City plans constructing water sys addns, water treatment plant, elevated storage tank, force mains, Docket Ohio 33-188. $1,070,000. FWA.

Oklahoma—U. S. Eng, 416 Wright Bldg, Tulsa, plans constructing manufacturing plant addn. To exceed $5,000,000.

Oregon and Washington — Bonneville Advisory Bd, Nez Perce, recommends to War Production Bd, constructing dam and powerhouse on Snake River, Nez Perce, Ore., $133,372,000; also dam, powerhouse, Five Mile Rapids, Snake River, Pasco, Wash., $21,258,000.

Pennsylvania—Industrial company plans constructing plant addns, extens, imprvs. $100,000. Total est $1,000,000 incl mchy and equip. Defense Plant Corp will finance.

Pennsylvania—Industrial company plans constructing plant, Racoon and Potter Twp. $29,000,000. Defense Plant Corp will finance.

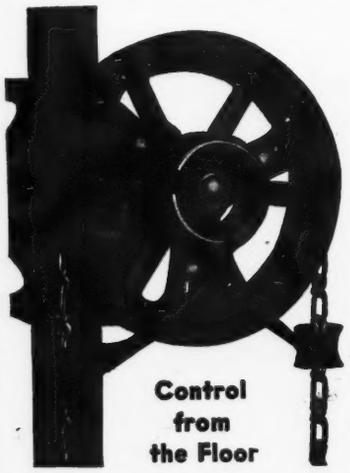
Pennsylvania—U. S. Eng, 925 New Federal Bldg, Pittsburgh, plans constructing manufacturing plant. Over $5,000,000.

Texas—Gulf Plains Corp, Corpus Christi, plans constructing plant. $5,000,000. Defense Plant Corp will finance.

Texas — Gulf Plains Corp, Corpus Christi, plans extending plant. $9,000,000. Defense Plant Corp will finance.

Texas—Industrial company plans renovating, expanding bldgs, facilities. $8,543,000 incl equip, etc. Defense Plant Corp will finance.

Make Your Overhead Valves SAFE And Easy to Reach---



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runs at gasoline engine, as well as at motor or turbine, speeds, making a clean, compact and neat unit in any combination.

The engine-driven unit shown serves as standby for a similar motor-driven IMO, insuring continuous supply of oil to burners in case of interruption to electric power.

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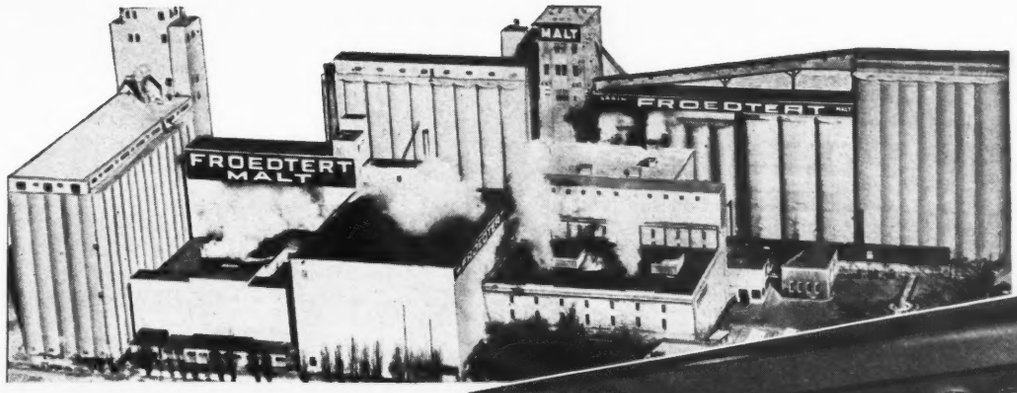

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FROEDTERT Grain & Malting Company, Milwaukee is the largest in the world with a yearly production capacity of 12,000,000 bushels and elevator and storage capacity of 9,000,000 bushels. Above is view of Hays Centralized Combustion Control panel. Arthur G. Behling was the consulting engineer on the boiler house extension.

FROEDTERT GRAIN & MALTING COMPANY of Milwaukee began a power plant rebuilding program in 1940—the fifth power modernization made necessary through nearly 60 years of growth. A complete new boiler plant was installed in 1941 consisting of two 6500 sq. ft. 3-drum, 3 pass, water-tube boilers with superheaters, economizers and water cooled furnaces fired by multiple-retort underfeed stokers. A complete Hays system of automatic combustion control centralized on a boiler operating panel maintains highest operating efficiency with steam pressure held constant regardless of load. The entire system is electrically operated with provision made for switching instantaneously from automatic to manual operation.

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THE MODERN SYSTEM—*it's Electric!*

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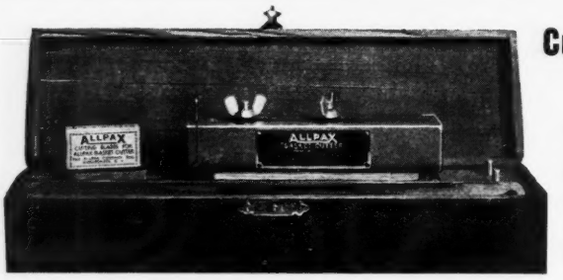

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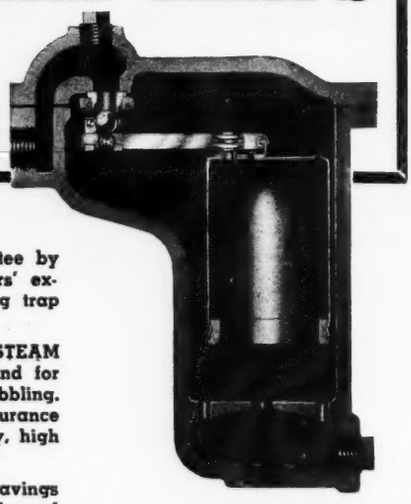
. . . guaranteed to discharge condensate at rated capacities and perform satisfactorily within the limits of pressure and capacity



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Available from ½" to 2½"—Capacities: 500 to 38,000 pounds of water at pressures from 1 to 250 pounds.

CRYER TRAP AND VALVE CO., INC.
MANUFACTURERS OF STEAM SPECIALTIES FOR MORE THAN 40 YEARS
366 MADISON AVE. NEW YORK, N. Y.

Texas—Pontiac Oil Co, Corpus Christi, bids soon constructing plant. $2,500,000. Defense Plant Corp will finance.

Texas—U. S. Eng, Citizens Bank Bldg, Denison, plans constructing plant. To exceed $5,000,000. Austin Co, 16112 Euclid Ave, Cleveland, O., awarded engr-archt-management contract.

Texas—U. S. Eng, Citizens Bank Bldg, Denison, plans constructing mfg plant. To exceed $5,000,000.

Texas—U. S. Eng, Denison, plans constructing plant. To exceed $5,000,000.

Texas—War Dept, 20 St and Constitution Ave, N W, Wash., D. C., plans constructing plant $6,000,000. Industrial co will operate. Shreve, Anderson & Walker, 914 Marquette Bldg, Detroit, Mich., engrs.

Texas, Denton—Texas State College for Women, Denton, received no bids Feb 17, constructing turbo-generator power plant unit. $40,000 or more.

Texas, El Paso—City plans $210,000 bond election April 4, constructing outfall sewer, treatment plant, pump station, pumps gas engines. Docket, Tex, 41-123. $420,700. FWA. Headman, Ferguson & Carollo, 319 Homebuilders Bldg, Phoenix, Ariz., engrs.

Texas, Houston—Bids Apr 15, by C A Pickett, mayor, constructing sewerage sys, disposal plant, Tex. 41-297. $2,530,-000. FWA. J G Turney, dir P Wks.

Texas, Houston—Houston Lighting & Power Co, 1016 Walker St, soon lets contract constructing power plant addn. Total est $5,000,000.

Texas, Rockport—Bids asked Apr 6, by City, c/o J E Moore, mayor, Rockport, constructing sewerage sys, disposal plant, relift pump station, pumps, etc, Docket Tex. 41-197. $90,000. M C St John, 4101 Polk Ave, Houston, engr. FWA.

Washington—Bonneville Advisory Bd, 811 Oregon St, Portland, Ore., offered for consideration to War Production Bd dam and powerhouse at Z canyon, on Clark's fork Columbia River, near Canadian Border. $27,640,000.

Washington—Bids Apr 28, by Bureau Reclamation, Customhouse, Denver, Colo., furnishing pipe, fittings, valves and cocks for Units L-4 to L-9 (inclusive). Grand Coulee power plant, Columbia Basin Proj, Spec 1614D; 2 circuit breakers, 2 selector type disconnecting switches with manually-gang-operated grounding blades and 2 manually gang-operated disconnecting switches for Grand Coulee power plant Spec 1031.

Washington—Bids May 4, by Bureau Reclamation, Customhouse, Denver, Colo., furnishing six 5000-amp bus structures, with current transformers, potential transformers and generator-protective lightning arresters, capacitors, for Units L-4 to L-9 (inclusive), Grand Coulee power plant, Columbia Basin Project, Spec 1030.

Wash., Odair—Bids Apr 28, by Bureau Reclamation, Customhouse, Denver, Colo., furnishing two 230 kv, 1200-amp circuit breakers and four disconnecting switches, Spec 1031 for Units L-1, L-2, L-4, L-5 and L-6 and pipe, fittings, valves, cocks for Units L-4 to L-9 (inclusive). Spec 1614-D, above for Grand Coulee Power Plant, Columbia Basin Project.

Wash., Odair—Bids May 4, by Bureau Reclamation, Customhouse, Denver, Colo., furnishing six 5000-amp bus structures complete with transformers and lightning arresters, Grand Coulee Power Plant, Columbia Basin Proj, Spec 1030.

Wis., Green Bay—Green Bay Water Comn., plans constructing reservoir, pump sta, electrical work, pump equip, flow-meters, chlorinators, J Donohue Eng Co,

One Hundred Years' Experience

. . . APPLIED TO 1942 PRODUCTION PROBLEMS

War time production goals emphasize the need for dependable power plant equipment—equipment that has proved itself in peace-time production. Efficiency and dependability are more important today than they ever were in the past.

For 100 years the Flynn and Emrich Company has been serving the Nation. Today the ultra-modern "F & E" Stokers embody its now century-old policy of QUALITY FIRST. In hundreds of plants that are producing implements of war, "F & E" Stokers day-in and day-out are proving their outstanding work.

TOP: *The "F&E" Heavy Duty Stoker Series 70. For boilers rated from 150 H.P. to 500 H.P. Furnished single or double retort, stationary or moving grates.*
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Every "F&E" Stoker embodies the famous "F&E" patented Interval Timer Governor that permits full-stroke, full-speed ram action—the essential to perfect underfeed firing. It also provides an infinite number of coal feeding rates. The Sliding Bottom Retort, the High Efficiency Tuyeres and the Fuel Bed Regulator combine to produce a combination of engineering features that no other stoker can offer.

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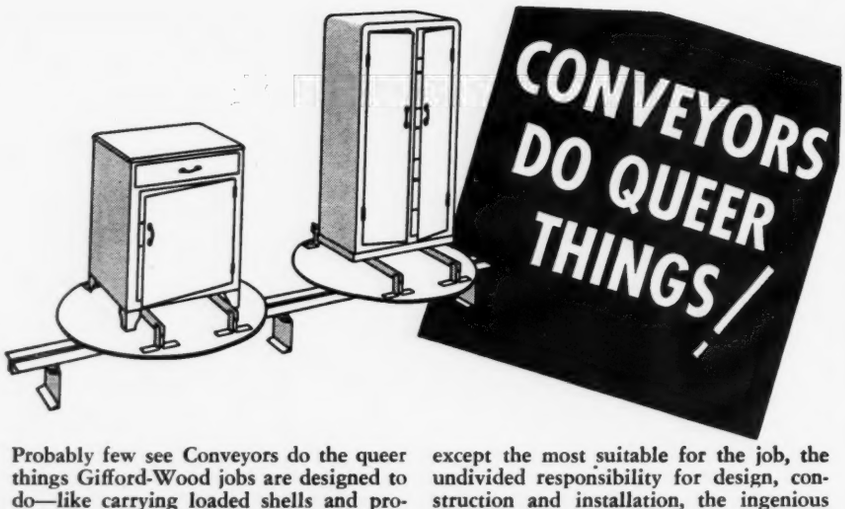

Probably few see Conveyors do the queer things Gifford-Wood jobs are designed to do—like carrying loaded shells and providing safety features if one should explode. Or carrying big cabinets on individual turntables, or thimble-sized parts on a spike, or toy tanks to be sprayed, or hush-hush equipment for bombers. Of course bulk material, machine parts, and packages are regular business for Gifford-Wood tailored to-order elevating and conveying systems.

The engineering approach to the problem, the absence of urge to "sell" any system except the most suitable for the job, the undivided responsibility for design, construction and installation, the ingenious mating of standard with special design for economy, the 128-year background of experience—all these fit Gifford-Wood to speed production for all-out requirements in busy defense plants.

Book 200P has 124 pages of good ideas for all who have elevating and conveying problems on their minds. A request on your business stationery will bring a copy promptly.

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Won't "Strike Out"!

As Uncle Sam calls for production "Home Runs", there is a greater need than ever for smooth, efficient factory floors. Ruts and holes don't go in the Victory League. So get busy with tough RUGGEDWEAR Resurfacer. Just the thing for sturdy patches or a complete, solid overlay. No chopping or chipping required. Merely sweep out spot to be repaired—mix the material—trowel it on. Holds solid and tight right up to irregular edge of old concrete. Cellulose-Processed to provide a firmer, tougher, smoother more rugged wearing surface. Used indoors or out. Dries fast. Low in cost.

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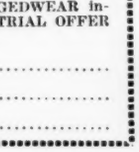

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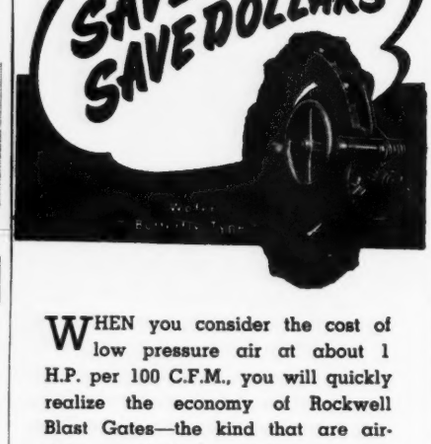

WHEN you consider the cost of low pressure air at about 1 H.P. per 100 C.F.M., you will quickly realize the economy of Rockwell Blast Gates—the kind that are air-tight, non-chattering and provide better control of your air lines.

Light, strong, carefully machined to close air-tight, Rockwell Blast Gates are available in all types. They can be made up in aluminum, monel, bronze or other alloy metals to meet your requirements.

Write for catalog 4020, W. S. Rockwell Co., 50 Church Street, New York.

★ Rockwell ★
BLAST GATES

608 N 8 St, Sheyboygan, engrs.

Wis., Oshkosh—J S Chase, city clk, bids soon constructing three 10 mgd sewage pumps, auxiliary pump and motor, sewage pump station, ½ mi storm sewers. F M Wolverton, city engr.

Wis., Portage—Wisconsin Power & Light Corp, 122 W Washington Ave, Madison, plans constructing substation and transmission line extens. $606,000.

Wis., Stiles—Oconto Electric Co-operative, Oconto Falls, plans constructing hydroelectric power plant. $200,000 REA allot Orbison & Orbison, 206 W. College Ave, Appleton, engrs.

Contracts Let

Ala., Fairfield—Tennessee Coal, Iron & RR Co, Fairfield, awarded contract for 73 Koppers-Becker coke ovens, auxiliary equip, to The Koppers Co, Koppers Bldg, Pittsburgh, Pa. Est. $7,000,000.

Calif., San Jose—J C Bateman, 590 Stockton Ave, awarded contract constructing cold-storage plant to E A Hathaway, 1275 Glen Eyrie Ave. $40,000.

Calif., Trona — American Potash & Chemical Co, 609 S Grand Ave, Los Angeles, awarded contract constructing plant addn, to United Engineers & Constructors, 816 W 5 St, Los Angeles, $1,000,000.

Connecticut — Industrial company awarded contract constructing two plants to Turner Constr Co, 420 Lexington Ave, New York, N. Y. Est $6,000,000. Federally financed. Albert Kahn & Associates, 345 New Center Bldg., Detroit, Mich., archts.

Connecticut—Industrial co awarded contract for design and construction improvements to Ford, Bacon & Davis, Inc, 39 Bway, New York. Est. $9,000,000.

Delaware—U. S. Eng, 1400 Penn Mutual Bldg, Independence Sq, Phila., Pa., awarded contract constructing improvements to Ross Electric Constr Co, Inc, Schulykill Ave and Bainbridge St, Phila., Pa., less than $1,000,000.

Del., Wilmington—War Dept, 20 St and Constitution Ave N W, Wash., D. C., awarded contract for design and construction, operation, additional facilities at two manufacturing plants, to Hercules Powder Co, Delaware Trust Bldg. Location not revealed.

Idaho—Yards & Docks, Navy Dept, 18 St and Constitution Ave N W, Wash., D. C., awarded contract constructing plant, to Morison-Knudsen Constr Co, 319 Bway, Boise, est $20,000,000.

Illinois—Industrial company awarded contract constructing assembly bldg, to Kaiser Ducett Co, 80 E Jackson Blvd, Chicago. Est $1,500,000. Federally financed.

Illinois — Industrial company awarded contract constructing plant, for War Dept, to Sumner Sollitt & Co, 307 N Michigan Ave, Chicago. Est. $1,000,000.

Illinois—U. S. Eng, 816 U. S. Courthouse & Custom House, St. Louis, Mo., and Adams and College Sts, Springfield, awarded general contract plant, to James Stewart Corp and Fugard, Oleson, Urbain & Neiler, W Adams and Lewis Sts, Springfield. Est $15,000,000 to $20,000,000. Industrial company will operate.

Illinois—War Dept, 20 St and Constitution Ave N W, Wash., D. C., awarded contract constructing plant to Bates & Rogers Const Corp, 111 W Washington St, Chicago. $15,000,000 to $20,000,000.

Md., Carderock—Yards & Docks, Navy

SPEED

WITHOUT SACRIFICING WORKMANSHIP . . .

. . . IN PIPING FABRICATION

TIME is America's most precious commodity. Every hour, day and month saved in the construction of additional power generating facilities means just that much more material produced to beat the enemy.

For nearly 40 years Pittsburgh Piping has been in business to *save time* in fabricating and erecting power and process piping. The systematized pre-fabrication of large assemblies under controlled shop conditions makes possible faster construction schedules and also produces better, more accurate workmanship than is possible in the field.

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"Double Eddy" says:
Can your business afford NOT to reclaim its dust
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Aside from dollar value, many of industry's materials today are precious, hard to come by. Every scrap, every dust particle must be saved. For example, in the production of tin, aluminum, magnesium, potash and other vital materials, Buell Dust Recovery Systems offer an efficient, economical method of reclamation at every point where dust is created — in pulverizers, dryers, sprayers, kilns, etc.

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We shall be glad to send you on request, a copy of our informative 24-page *"Bulletin P-5, Dust in Industry".*

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Buell (van Tongeren) Dust Recovery Systems offer every user these six plus advantages . .

- ✚ *High Recovery Efficiency*
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CONSULT BUELL *First* IN DUST RECOVERY
for Chemical • Rock Product • Metallic • Food • Flue or any other dusts

buell DUST RECOVERY SYSTEMS

Dept, Wash., D. C., awarded contract constructing transformer substation. Naval Experimental Model Basin, Spec 10756, to Whiteley Electric Co, 13 N Carey St, Baltimore, Md. $61,000.

Massachusetts — Industrial company awarded contract constructing factory to Turner Constr Co, 420 Lexington Ave, New York, N. Y. Est $3,000,000. Federally financed, Albert Kahn & Associates, 345 New Center Bldg, Detroit, Mich., archts.

Mass., Mansfield—S W Card Mfg Co, Div Union Twist Drill Co, 70 Munroe St, Athol, awarded contract constructing 30x 100 ft. brick, heat-treating bldg, concrete fdn, to E J Cross Co, 150 Prospect St, Worcester, approx $40,000 incl equip. A Johnson, 390 Main St, Worcester, archt.

Michigan—Industrial company awarded contract constructing factory, for War Dept, to Turner Constr Co, 420 Lexington Ave, New York, N. Y. $3,500,000 Defense Plant Corp with finance. Austin Co. 16112 Euclid Ave, Cleveland, Ohio, archts and engrs.

Michigan—Industrial company awarded contract constructing mfg plant, plain fdn, to Owen-Ames Kimball Co, Benton Harbor. Defense Plant Corp will finance. Giffels & Vallet, 1000 Marquette Bldg, Detroit, engrs.

Michigan—Industrial company awarded contract constructing factory, to Kriegshoff Co, 6661 French Rd, Detroit. Defense Plant Corp will finance. Buckheit & Stuchell, 804 Lafayette Bldg, Detroit, archts.

Minnesota—Cargill, Inc, 761 New Chamber of Commerce Bldg, Minneapolis, will construct improvements for Navy Dept, own forces.

Nebraska—U. S. Eng, 1709 Jackson St, Omaha, awarded contract constructing plant, to Metcalfe Const Co, Ry Exch Bldg, Hamilton Constr Co, 1055 W 56th St and Kansas City Bridge Co, BMA Bldg, all Kansas City, Mo. Est $25,000,000.

New York—U. S. Eng, Chimes Bldg, Syracuse, awarded contract constructing improvements, Sect A to D W Winkleman Co, Heffernan Bldg, Syracuse, $2,726,107; Sect B to William L Crow Constr Co, 101 Park Ave, New York, $3,737,363.

New York—War Dept, 20 St and Constitution Ave, N W, Wash., D. C., awarded contract constructing plant, to Lummus Co, 420 Lexington Ave, New York. Est over $5,000,000.

N. C., Southport—Bd Aldermen, City Hall, awarded contract constructing exten light and power plant, Docket NC 31-176, Sect A, generator equip, to Fairbanks, Morse & Co, 515 Whitehall St, N W, Atlanta, Ga. $57,720. Bids Feb 17. Rejected bids Feb 17, Sects C and D FWA.

Ohio—U. S. Eng, Columbus, awarded contract constructing mfg plant to Hunkin Conkey Constr Co, 1740 E 12 St, Cleveland. Est $5,000,000. Industrial company will operate.

Ohio—War Dept, 20 St and Constitution Ave, N W, Wash., D. C., awarded contract constructing plant to Shreve, Anderson & Walker, 914 Marquette Bldg, Detroit, Mich. $5,000,000.

Ohio, Cleveland—Steel Imprvt & Forge Co, C H Smith, pres, 960 Addison Rd, awarded contract constructing boiler house, to J L Hunting Co, Chester-Ninth Bldg, Est, $40,000 incl equip. W C Kammerer & Associates, 1900 Euclid Ave, consult engrs.

Ohio, Dover—City awarded contract for power piping, municipal light plant, to Johnson Larsen & Co, 6530 Beaubien St, Detroit, Mich. $41,290. Est $50,000.

...but UNFIT for Industrial use

WATER as it occurs in nature may be sparkling and clear—it may even be pure enough to drink—but without conditioning, it is rarely suitable for either power or processing needs.

Betz is an organization of engineers and chemists trained and skilled in detecting and correcting all qualities of water that might limit its usage for any particular water application. Betz service includes Consultation, Plant Studies, Plant Design and Service Supervision for Boiler Water, Process Water, Municipal Water, Waste and Sewage Disposal.

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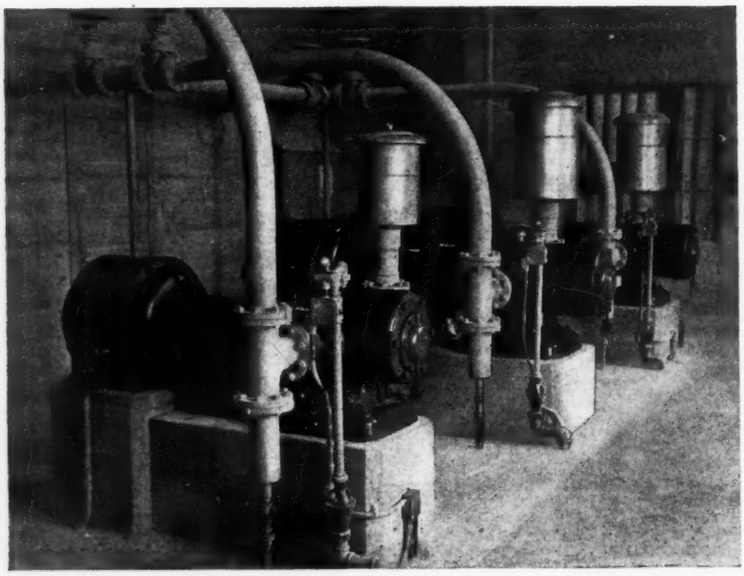
CHEMICAL ENGINEERS AND CONSULTANTS ON ALL WATER PROBLEMS

A West Coast Company uses 16 FULLER ROTARIES



Just another result of the satisfactory operation of one Fuller Rotary Compressor installed in 1934 by a West Coast cement company. The excellent over-all performance of this initial installation "sold" this company on Fuller Rotaries. Result — the installing of 16 units up to the present time. Included in this total are seven machines purchased in 1940, when it was decided to rebuild and modernize this plant, three of which are shown in the above illustration.

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Now Streamlined For War
Prizes Doubled—Now
$1000.00
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Rules Free—Write Educational Director Compressed Air Inst. East Orange, N. J.

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C-68

FULLER
PIONEERS OF HIGH-EFFICIENCY ROTARY COMPRESSORS

Ohio, Xenia—M C Smith, city mgr, awarded contract constructing well, pump equip, pump house, to Layne Ohio Co, 1100 W Town St, Columbus, $15,134. Est $15,000.

Pennsylvania — Industrial company awarded contract constructing two factory addns, own forces; structural steel, to Erie Steel Const Co, Geist Rd and N Penna R R, Erie. Est under $1,000,000. Federally financed.

Pennsylvania—Industrial company awarded contract constructing factory addns, to H T Osborne, Miller Park, Franklin. Est under $1,000,000. Federally financed.

Pa., Middletown—War Dept, 20 St and Constitution Ave, N W, Wash., D. C., awarded contract furnishing transformer substation to Elco Installation Co, 345 E 23 St, New York, N. Y. $44,886.

Rhode Island—Rheem Mfg Co, 1041 Hospital Trust Bldg, Providence, awarded contract constructing improvements, to Brown & Matthews, Inc. 122 E 42 St, New York, N. Y. Est $3,000,000.

South Carolina—U. S. Eng, 33 Customhouse, Charleston, awarded contract constructing improvements, to Daniel Constr Co, Anderson, and A H Grion & Co, Kinney Bldg, Charlotte, N. C. $2,418,393.

Tennessee—U. S. War Dept, 20 St and Constitution Ave, N W, Wash., D. C., awarded contract for design, engineering and construction mfg plant, to E I Du Pont De Nemours & Co, Du Pont Bldg, Wilmington, Del., over $5,000,000.

Texas—Consolidated Steel Corp, Ltd, will construct improvements, force account. $2,800,000. Federally financed.

Texas—Southwestern Iron Steel & Coke Co, c/o W O Irvin, pres, Natl Bank of Daingerfield, Daingerfield and J W Carpenter, Interurban Bldg, Dallas, operators, will construct plant. $14,850,000. Defense Plant Corp will finance.

Texas—War Dept, 20 St and Constitution Ave N W, Wash., D. C., awarded contract constructing plant, to McKenzie Constr Co, Smith-Young Tower, San Antonio. Over $5,000,000. Freese & Nichols, Capps Bldg, Fort Worth, engrs. Industrial Company will operate.

Texas—War Dept, 20 St and Constitution Ave, N W, Wash., D. C., awarded contract constructing plant, to W E Callahan Constr Co, 2034 Moxley St, Dallas. Approx $38,000,000. Howard, Needles, Tammen & Bergendorff, 55 Liberty St, New York, N. Y., engrs.

Texas, San Antonio—U. S. Eng, Fort Sam Houston, awarded contract constructing boiler house, to H B Kilstofte, Builders Exch Bldg, $144,888.

Utah—Industrial company awarded contract constructing plant, to Leonard Constr Co, 37 S Wabash St, Chicago, Ill. Est $2,000,000. Defense Plant Corp will finance.

Washington—Bonneville Power Admin, P O Box 3537, Portland, Ore., awarded contract for transformers for substations, Ampere, Covington and Spokane, Inv 2581, to General Electric Co, 1 River Rd, Schenectady, N. Y. $1,891,590.

Wash., Ampere — Bonneville Power Admin, P O Box 3537, Portland, Ore., awarded contract furnishing 12 oil circuit breakers for substation. Inv 2568, to General Electric Co, 1 River Rd, Schenectady, N. Y. $877,415.

Wash., Longview — Bonneville Power Admin, P O Box 3537, Portland, Ore., awarded contract furnishing 10 self-cooled transformers for substation, Inv 2578, to Allis-Chalmers Mfg Co, 1126 S 70 St, Milwaukee, Wis. $1,196,925.

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calls for top-speed production without frequent interruptions for re-packing and for replacing gaskets.

The dependability of all Garlock products is helping industry maintain Vital, non-stop, smooth-running production.

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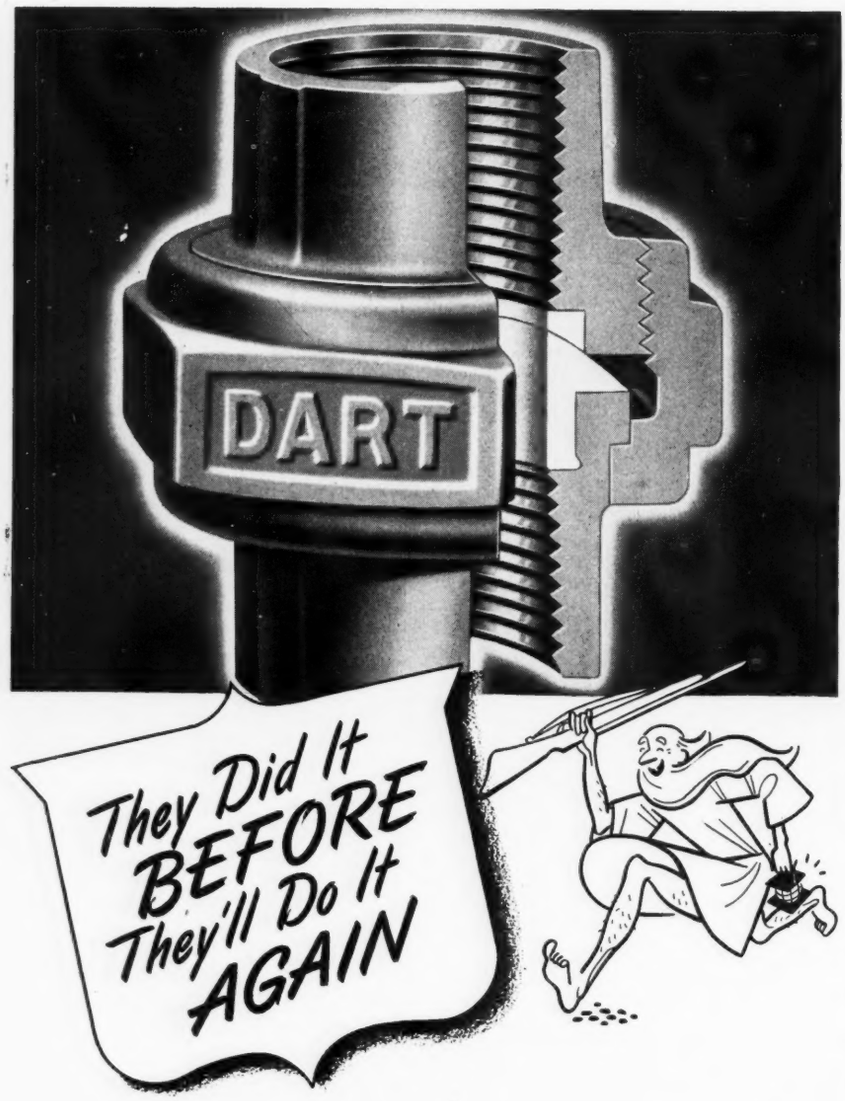

Search your plant for Dart Unions that have already "done their stuff". They can do it again. That is, they can *still* make up tight and the first time, quickly and easily—and *stay* tight unfailingly. Magic performance? Not quite. A Dart's long life is due to a Dart's construction . . . it's *matched bronze seats*, ground to "true ball" surfaces . . . air refined malleable iron nuts and bodies that resist pipe abuse and corrosion.

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DART UNIONS

E. M. DART MFG. CO. PROVIDENCE, R. I.

Power Lines

(*Continued from page* 122)

the priorities analysts in their efforts to act quickly on all applications.

Question No. 2, relating to the function of the equipment desired to be purchased and the type of establishment in which it would be installed, is extremely important, officials said. Applicants must furnish information under this question on whether the equipment would replace, repair or expand existing facilities, and must state definitely whether or not a complete new installation is contemplated.

Question No. 3 requires a complete description of the material wanted, and the name of the supplier. Under this question, applicants also must give the dates of any other preference rating applications they may have pending, and state whether they intend to file additional applications.

Question No. 7 relates to the supply situation in the event a rating is not obtainable. If an applicant's request is for various products which will go into inventory, the present inventory position on each item should be clearly outlined under this question, and the per cent of annual consumption of present inventory should be stated.

If these and other questions are fully answered, officials said, they will be able to make an intelligent appraisal of the need for and essentiality of the products or raw materials requested.

Alex Dow Passes

Alex Dow, internationally known utility executive and chairman of the board of the Detroit Edison Co, died of pneumonia on March 22 at the University of Michigan Hospital, Ann Arbor. He would have been 80 years old on April 12. Mr Dow was born in Glasgow, Scotland, and received his elementary education there. Before he was 12 he was employed in Glasgow as a messenger, and later as a clerk and stenographer for a railroad. When he was 18 he went to work for the Cunard Steamship Line in Liverpool as a clerk, devoting his spare time to the study of marine engines. After a brief period in the British army. Mr Dow came to this country in 1882, settling in Baltimore, where he was employed in the various departments of the Baltimore & Ohio Railroad. In 1893 he came to Detroit to design and supervise the

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POWER RATIONING SYSTEM

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Power—the heart of war production—must not be wasted. Using more than is necessary for any given job may mean a lack somewhere else. Power must be rationed—and Masoneilan pressure regulators do an accurate, reliable, impersonal job.

Types for every service are available—pilot or direct operated—for steam, air, or water; high or low pressures. Take the first step in setting up your power rationing system—send for Bulletin No. 69.

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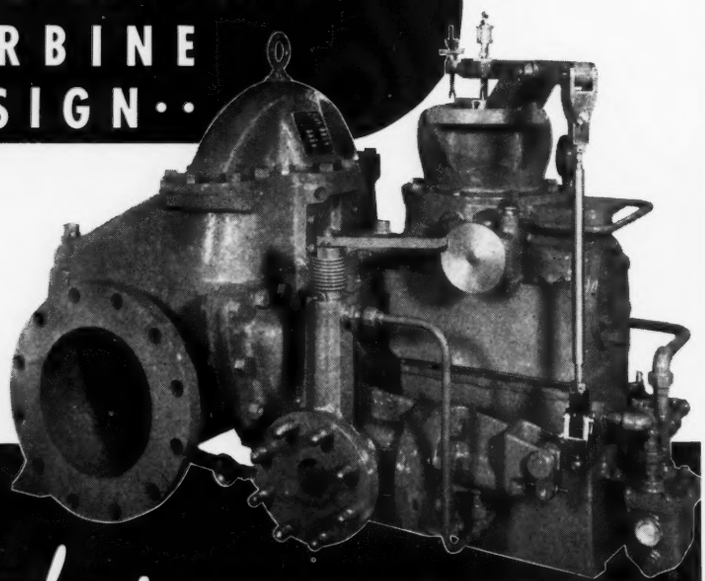

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POWER FACILITIES FOR *Now*
AND FOR THE *Future*...

The type "U" turbine shown above is arranged for forced feed lubrication. At the end of turbine shaft is mounted a vertical spindle at the top end of which is the standard Type "U" governor and at the lower end of which is lubricating oil pump enclosed in tank. View shows governor linkage, oil cooler, overspeed governor, etc. Turbine was rated 90 h. p. at 3550 r. p. m., operates at 400# initial pressure, 750° F total temperature, and 20# back pressure. It is used to drive a boiler feed pump. It is used in the plant of a large manufacturer of insulating board in Mississippi.

• Those who have Murray Equipment now will be in a more secure position as far as power requirements are concerned, for the future.

For example, the Type "U" Turbine is adaptable to widely varying operating conditions—it is an ideal drive for generators, pumps, fans, blowers, and miscellaneous machinery. All construction features are carefully coordinated for either direct drive through flexible couplings, or combination Murray reduction gear drives.

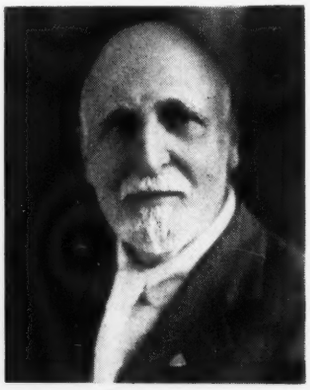
Bulletin T-118 is valuable now to those who have high priorities—those who are not in this purchase group will find it advisable to have this bulletin on hand so that future turbine needs can be planned.

Bulletins also available on MURRAY BOILERS and ENGINES.

BOILERS TURBINES ENGINES

MURRAY
IRON WORKS COMPANY
INCORPORATED 1870
BURLINGTON IOWA

construction of the city's public lighting plan. Three years later he became associated with the Edison Illuminating Co, forerunner of the Detroit Edison Co. He became president of the latter in 1912, serving until 1940, when he became chairman. In 1936 Mr Dow



received the Edison medal of the American Institute of Electrical Engineers. Mr Dow served several times as a member of the Detroit Board of Water Commissioners, being president from 1925 to 1932. He was a member and a 1928 president of the American Society of Mechanical Engineers; honorary member of the American Society of Electrical Engineers, the Institute of Electrical Engineers (Great Britain), and the Newcomen Society of England. In 1932 he was appointed district chief of the Detroit Ordnance District, War Department, and continued to serve in that capacity until his death. In recent years he made his home on his estate near Ann Arbor. It was largely under Mr Dow's direction that the Detroit Edison Co expanded into the largest public utility in southeastern Michigan, and one of the foremost in the country.

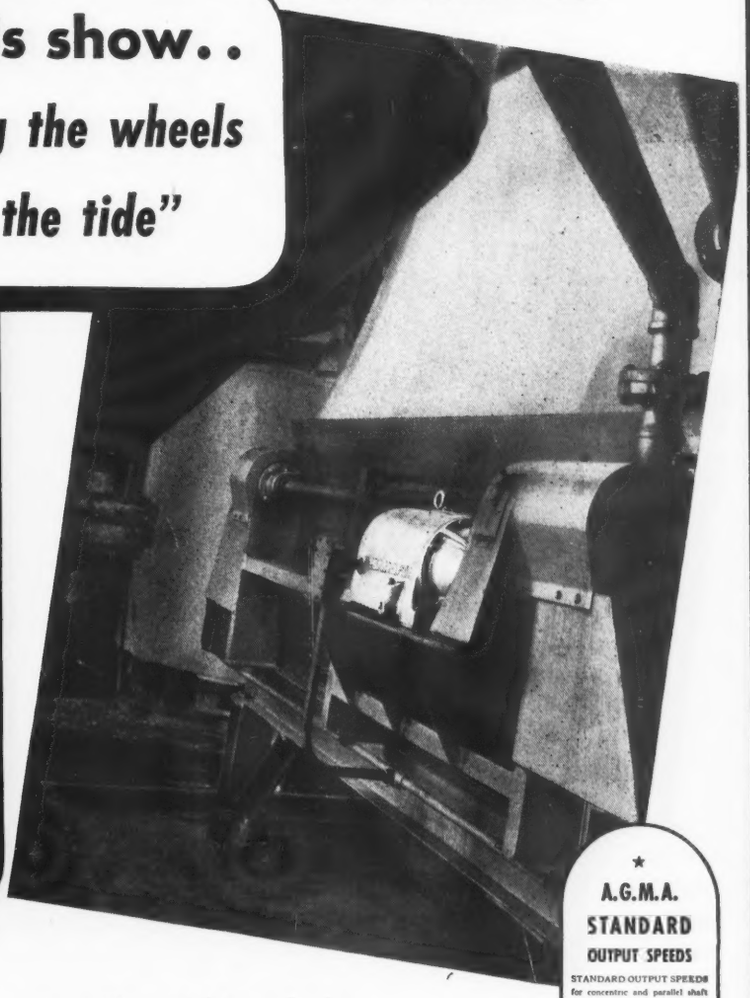
J E Tobey Heads New Coal Bureau

Julian E Tobey, vice-president of Appalachian Coals, Inc, of Cincinnati, has resigned his position, effective April 15, to become managing director of the newly organized Coal Bureau of the Upper Monongahela Valley Association, with headquarters in Arlington, W. Va.

The new Coal Bureau was formed by coal industry leaders in ten West Virginia counties and the Upper Monongahela Valley Association to exploit the vast reserves of high volatile low-fusion coals in this area, whose basic fuel value is not generally appreciated. The bureau plans, through an engineering advisory service, to bring

Philadelphia
MOTOREDUCER

The records show..
"They're turning the wheels that will turn the tide"



America's war needs demand all-out production with plants operating night and day. Sturdy drives are required to stand this pace and keep production rolling. Over the years Philadelphia MotoReduceRs when properly selected have proven their dependability and rugged construction that assures long trouble free service. These self-contained drives are made in both horizontal and vertical types. They're compact to save valuable space and efficient (up to 97%) in operation. Tell us your requirements or send for the MotoReduceR catalog today.

★
A.G.M.A. STANDARD OUTPUT SPEEDS

STANDARD OUTPUT SPEEDS for concentric and parallel shaft integral hp Gearmotors. Based on 1750, 1430 or 1165 rpm motor operating speeds.

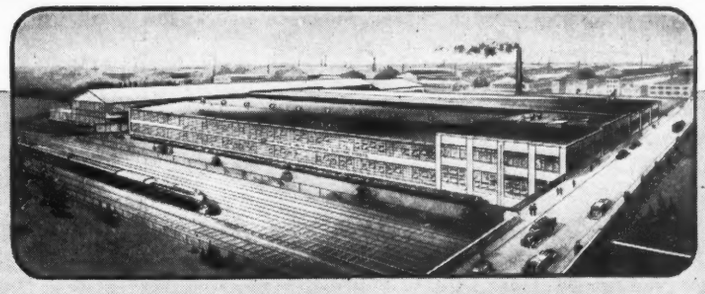
1430	190	25
1170	155	20
950	125	16.5
780	100	13.5
640	84	11.0
520	68	9.0
430	56	7.5
350	45	6.0
280	37	5.0
230	30	4.0

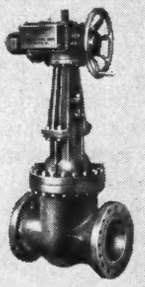
AGMA

PHILADELPHIA GEAR WORKS

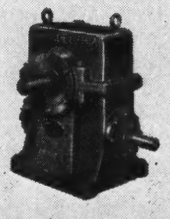
INDUSTRIAL GEARS
AND SPEED REDUCERS
LIMITORQUE VALVE CONTROLS

ERIE AVENUE & G STREET
PHILADELPHIA, PA.
New York, Pittsburgh, Chicago





Philadelphia
LIMITORQUE CONTROL
operates all types of valves, etc., safely, economically, from convenient stations.



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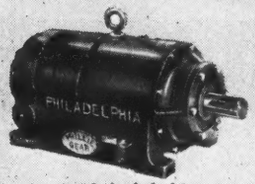
WORM GEAR SPEED REDUCER
right angle drives — vertical or horizontal. Wide range of ratios and horsepowers.



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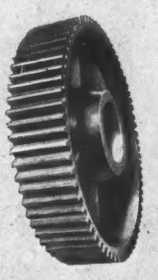
MOTOREDUCER
The economical self-contained drive, Horizontal or Vertical types — various ratios and horsepowers.



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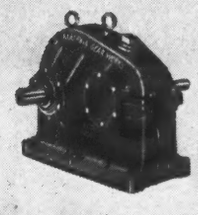
GEARS
All types and sizes of industrial gears. Can be supplied in all materials.



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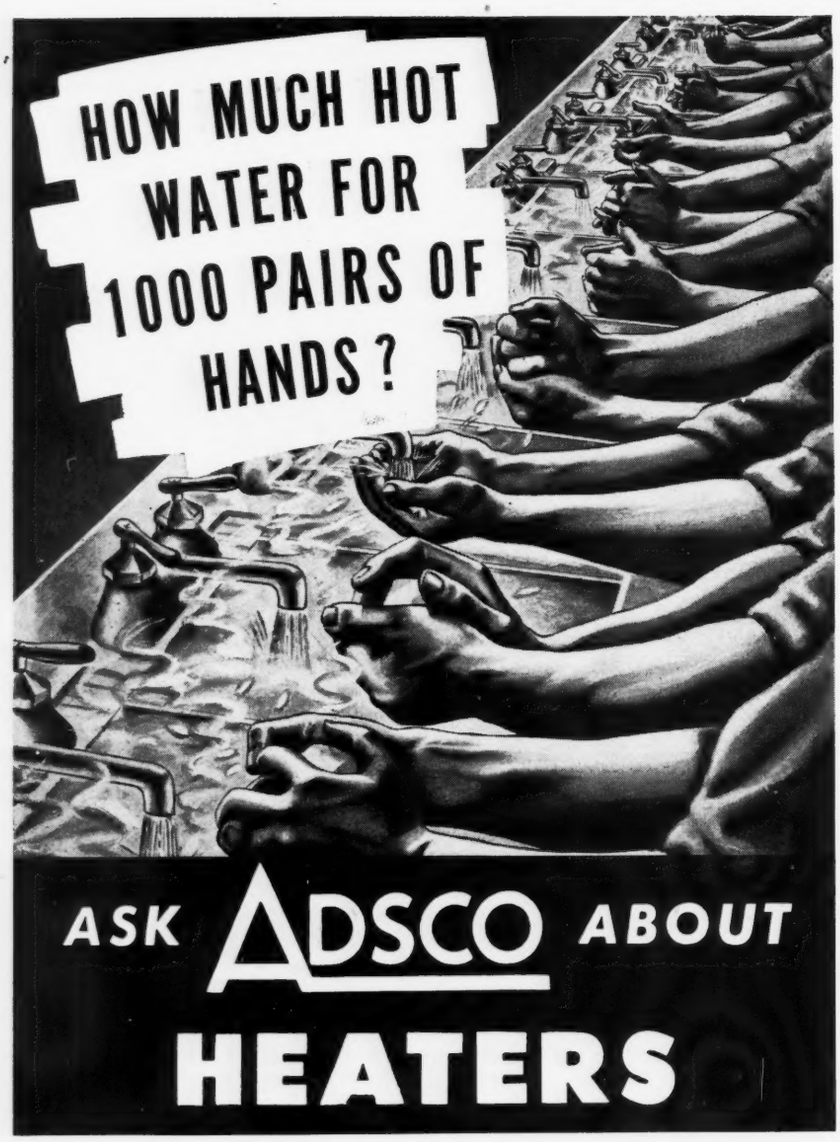
HERRINGBONE SPEED REDUCER
for heavy loads at high speed. Single, Double, Triple Reductions, various ratios and horsepowers.



ADSCO Storage Water Heater, Vertical Type.

Your water heating problem may be quite different from determining the size of heater required to "wash 1000 pairs of hands"—but whatever it is, ADSCO can give you the right answer.

For many years ADSCO have built heaters of various types, sizes, capacities and pressures for some of America's largest industrial plants, commercial establishments, colleges and institutions.

As a result, ADSCO has the experience and facilities to build a heater that is just right for your job. Whether you require a horizontal or vertical heater —storage or instantaneous—a heat economizer or special equipment to heat or cool water, oil or other liquids, ADSCO can furnish a unit to meet your exact operating conditions. Submit the details of your heating or cooling problem or write for bulletins.

AMERICAN DISTRICT STEAM COMPANY N. TONAWANDA N. Y.

Making "UP-TO-DATE" Steam Line Equipment For Over 60 Years

STORAGE • INSTANTANEOUS • ECONOMIZERS

about an understanding of the economic possibilities of Pittsburgh seam coal, through the installation of modern combustion equipment.

Tobey, in 1934, was selected to organize and head the Fuel Engineering Division of ACI, because of his knowledge of fuels, utilization, and consumers' problems. His background as chief power engineer for the Studebaker Corporation; as a consultant; and as an engineering officer in the U S Navy, gave him a broad experience in fuels and combustion for which there was a definite need in the coal industry.

In his work for ACI Tobey developed many phases of fuel engineering on a large scale. The 26 ACI Fuel Engineering Conferences, held between 1934 and 1941 in various cities af-

Julian Tobey

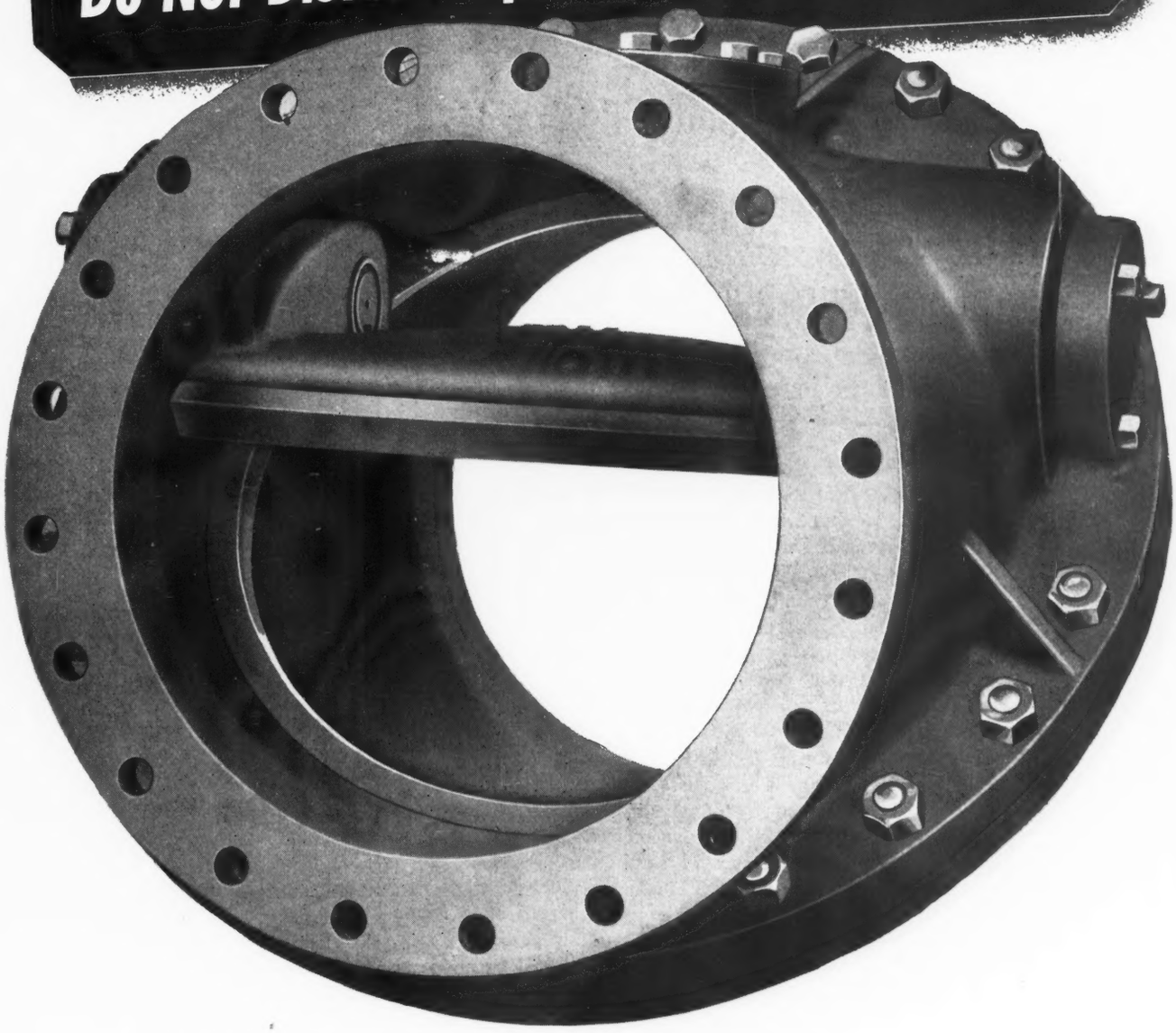
fecting more than 20 states, did much to improve coal utilization.

Thousands of retail coal men have benefited from the stoker schools, coal exhibitions, lectures, fuel surveys, and the wealth of educational literature, sponsored by the fuel engineering division of ACI, under Tobey's direction. Hundreds of cases of troubleshooting for producer-members in consumers plants were handled by Tobey and his staff.

Active as a member of several national engineering societies, (past-chairman of the Coal Division of AIME, Mr Tobey is vice-chairman, Ohio State Board of Registration for Professional Engineers and Surveyors, Director of Engineering for the Coal Producers Committee for Smoke Abatement, Chairman of the Technical Advisory Board and Technical Executive Committee of Bituminous Coal Research, Inc, and a member of the Executive Committee, Fuels Division, ASME. In these ways, this well-known engineer serves the industry and his profession.

QUIET

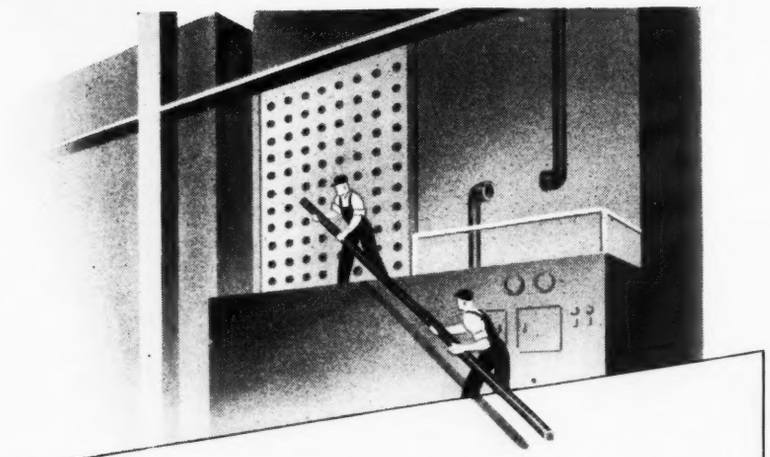
Do Not Disturb Pipe-Lines or Flange-Joints



NO SLAMMING when a Chapman Non-Slam Check Valve closes . . . so there's no hammering or surging to jar the lines or open up the joints. For the balanced, airfoil disc rides without flutter in the open position, above. And as the flow stops, this single moving part is cushioned silently to a drop-tight seat. There's no rubbing or wear in the valve itself, so it lasts indefinitely . . . without trouble or maintenance. 12-page book contains power plant photos and full engineering data on installation and regulation. Write for your copy now, to

The Chapman Valve Mfg. Co., Indian Orchard, Mass.

CHAPMAN *Tilting Disc* NON-SLAM Check Valves



HOW FERRISUL CAN HELP YOU
GET MORE POWER AND LONGER LIFE
FROM YOUR PRESENT BOILERS

KEEP your boiler feed water free from scale-forming silica and organic substances with Ferrisul—and you'll add vital extra pounds to your steam output and equally vital hours to the life of your boiler tubes and turbine blades.

Ferrisul (anhydrous ferric sulfate) rids boiler feed waters of silica and other enemies of heat transfer efficiency *without* leaving equally dangerous, scale-forming or corrosive residuals. Because its floc is highly adsorptive, forms immediately and is stable over the entire pH range above 3.5, even small amounts will remove some silica and complete removal of both silica and organic substances is usually both practical and economical.

Dry and free-flowing, Ferrisul is easy to handle and requires no expensive storage tanks. It can be carried by any standard conveyor system and introduced into the treatment in standard dry feed machines or solution feeders. It is shipped in sturdy, moisture-proof containers which can be stored indefinitely without danger of deterioration or in Dry-Flo freight cars which can be automatically unloaded as easily as liquid from a tank car.

Monsanto's experienced technical staff will be glad to study your needs and recommend the most economical and effective treatment for your particular system. For full details, inquire: MONSANTO CHEMICAL COMPANY, Merrimac Division, Everett Station, Boston, Massachusetts.

MONSANTO CHEMICALS

"E" for Excellence . . . the pennant denoting the highest service accomplishments in the United States Navy . . . flies with the Naval Ordnance flag over Monsanto. In the words of the Secretary of the Navy, this award has been made to Monsanto "in recognition of your outstanding efforts in the production of ordnance materiel vital to our national defense."

SERVING INDUSTRY . . . WHICH SERVES MANKIND

Power Show Plans

Plans for the 15th National Exposition of Power & Mechanical Engineering, scheduled for Grand Central Palace, New York, November 30 to December 5, this year are progressing. Better known as the National Power Show, this widely recognized biennial event assumes an important role in helping industry's power facilities to meet the great demands of war production.

As an aid to increasing war production, displays will show ways and means of utilizing existing facilities to obtain more out of them; will educate the thousands of new operating men on the latest methods and equipment for the generation, transmission and utilization of power. Methods of conserving fuel, obtaining greater production through more accurate control of operations, utilizing substitute materials to overcome priorities problems, providing adequate emergency facilities, etc will also be promoted. Engineers and operating men will learn quickly and conserve vital time by visiting the 1942 Power Show.

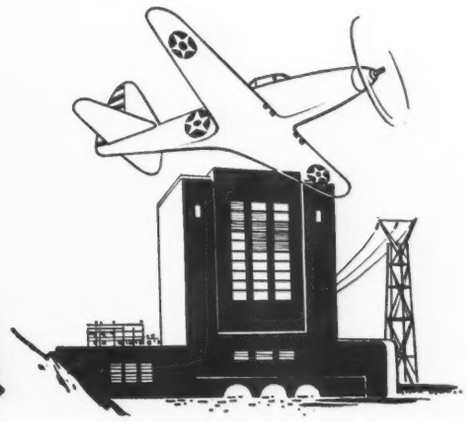
While the exposition is still many months away, 100 leading manufacturers have already engaged space and are making plans to show and tell what they are doing to provide important help in promoting greater production of war materials. 34,087 visitors registered at the 1940 Power Show, and it is expected this year's event will attract an even larger audience.

"Production for Victory" ASME Meeting Keynote

The spring meeting of the American Society of Mechanical Engineers which was held in Houston, Texas, March 23–25, had as its keynote, "Engineering Production for Victory."

Among the technical papers presented the following were of special interest to power men: "Natural Gas—Production, Distribution and Utilization", W B Poor; "Marine Boilers", T C Stillman; "Effect of Valve-Seat Deflection", Harte Cooke; "Protection of Buried Metals Against Corrosion", Starr and Thayer; "A Review of Heat-Transfer Coefficients and Friction Factors for Tubular Heat Exchangers", B E Short; "Condensation of Saturated Freon-12 Vapor on a Bank of Horizontal Tubes", W J Wohlenberg and F L Young Jr; "Heat Transfer, Pressure Drop, and Fouling Rates of Liquids for Continuous and Noncontin-

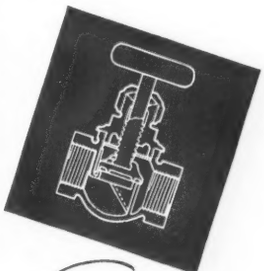
FOR WANT OF A NAIL!
For want of a nail a shoe was lost
For want of a shoe a horse was lost
For want of a horse a man was lost
And for want of a man a battle was lost!



FOR WANT OF A VALVE

For want of a valve, steam was lost
For want of steam, metal was lost
For want of metal, a plane was lost
For want of a plane, a fortress was lost!

THAT rhyme is just another way to say that it now has become imperative that valves—particularly the valves *you* use—be maintained at the peak of efficiency. . . . Ordinarily that might mean replacement of many valves. But today valve metals are on the critical list. It has become un-American to replace valves that can be restored through repair or replacement of parts. And it is true Americanism to revert to old time thrift when checking the conditions of each valve and *"use it, mend it, make it do."* . . . As a matter of fact, Pratt & Cady, by their invention of the Globe Valve with renewable seat and disc made this possible. You *can* renew your valves by first, resurfacing disc and seat—or wedge and seat—to a new seal. Then, when they are completely worn out, replace only these smaller parts. To be sure, the delivery of seats and discs is also subject to government regulations, making it good business to check the condition of your valves in plenty of time.

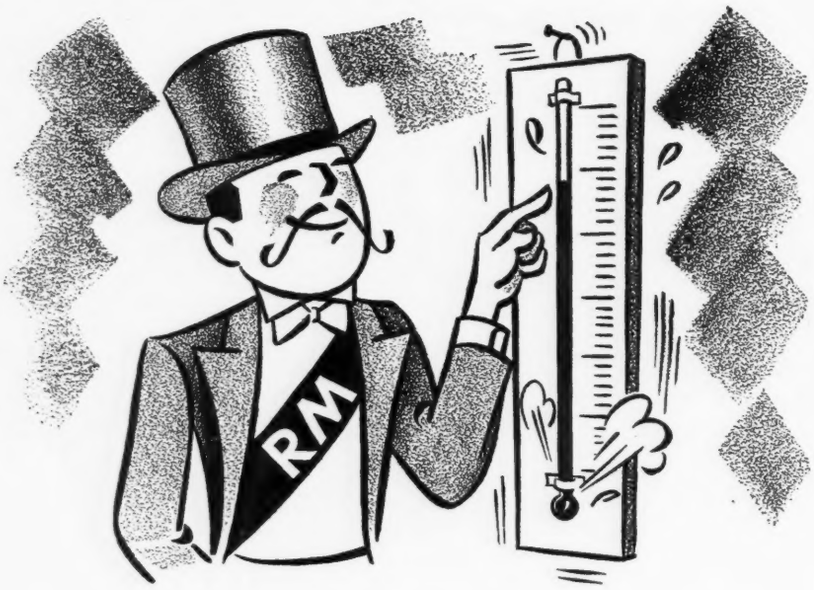


1885

Taken from one of the original Pratt & Cady Globe Valve patent drawings

READING-PRATT & CADY
READING, PENNSYLVANIA

A Division of AMERICAN CHAIN & CABLE COMPANY, INC. *Bridgeport, Conn.*



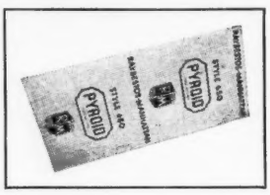
As war drives operating temperatures still higher, insist on

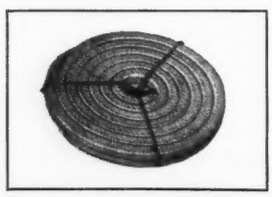
R/M PACKINGS

These are the days when you can be especially glad you bought R/M packings; for the war production speed-up is asking packings to meet higher temperatures for longer periods . . . and R/M packings are meeting them.

Always made a little better than necessary for ordinary requirements, R/M packings have proved to be real life- and time-savers in many industries where sudden conversion to war production has put extra burdens on packings. Our entire resources are now devoted to two objectives: To make R/M packings even more efficient and to meet the unprecedented demand for delivery.

In our keyed, illustrated and indexed catalog you will find the answers to most of today's industrial packing problems. See your R/M distributor or write for a free copy.





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MANHEIM, PA.
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Makers of Packings for Every Industrial Use

uous Longitudinal Fins", A Y Gunter and W A Shaw; "Operation and Maintenance of Air Preheaters, Joseph Waitkus; "Construction of Water-Cooled Furnaces", Max Kuhner; "A Method of Selection of Optimum Size Economizers and Air Preheaters", E N Kemler and Linn Helander; "Quick and Flash-Freezing of Foods: The Fundamental Theories and Applications", W R Woolrich and L H Bartlett; "Automatic Control of Natural Gas Fuel Power Boilers", C W Parsons. A feature of the Houston program was a round-table discussion on trouble shooting on gas and oil burners. Among those taking part in this discussion were E L Dennis; R C Vroom, L S Reagan and C L Orr.

OBITUARIES

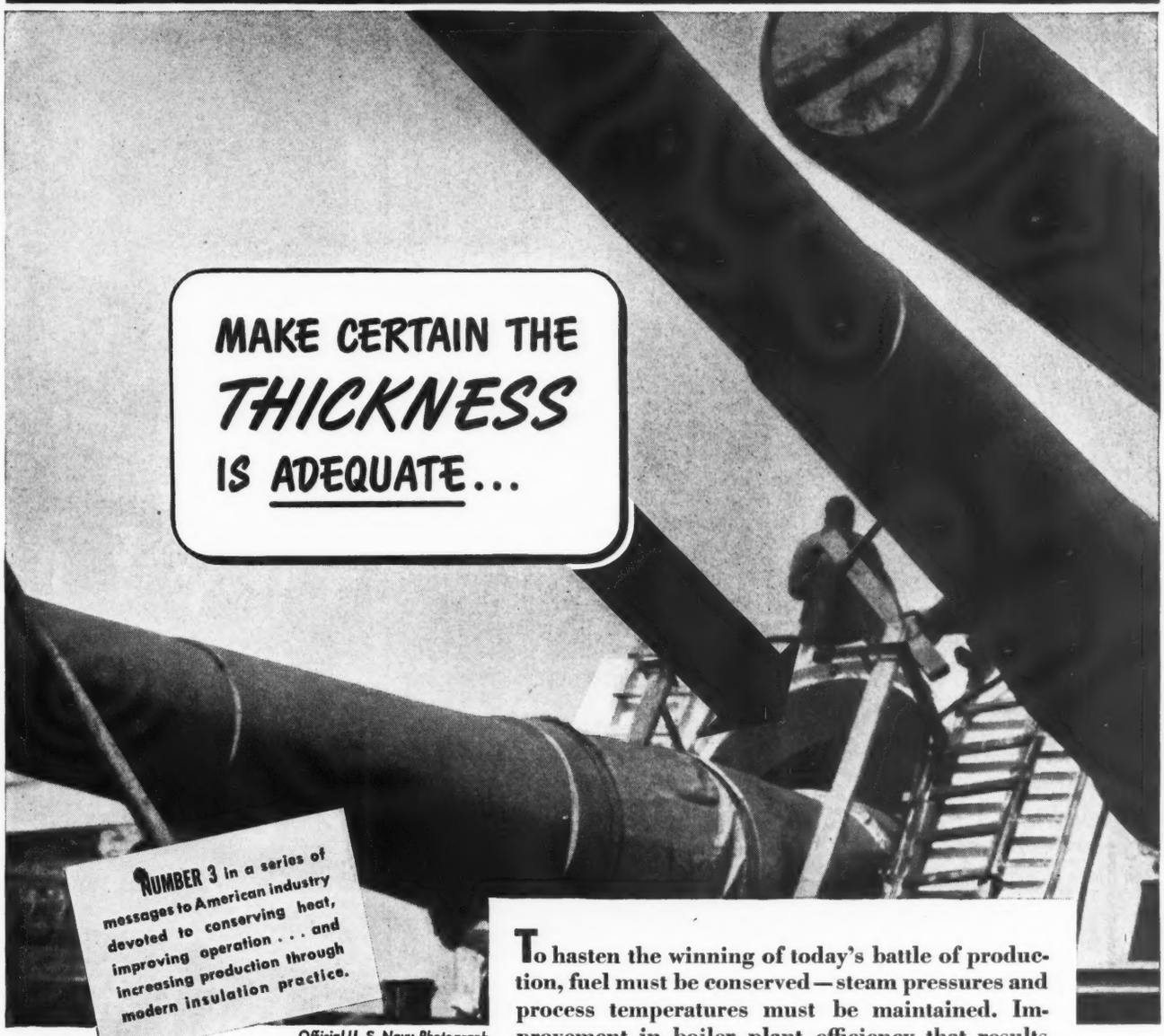
JAMES F RAWDON, 63, an inspector of marine boilers for the federal government since 1917, and for a time an engineer at the Narragansett Electric Co's steam plant in Providence, R. I., died at the Boston City Hospital on April 2. He was a native of Worcester, Mass., and in early life was chief engineer of the Geneva Worsted Mills, Providence, before entering upon a long career in marine engineering. He was a graduate of the Rhode Island School of Design and the Massachusetts Nautical Training School.

CHARLES S TARDY, 70, manager of the Bedford Power Co at Snowden, Va., for the past 33 years, died suddenly April 3.

WILLIAM S EICHELBERGER, Philadelphia district sales manager for the Consolidation Coal Co, died at Merion, Pa., on March 13. Mr Eichelberger joined the company in July, 1925, and at various times was engaged in sales activities with the company's Cleveland, Philadelphia and Baltimore offices. In July, 1937, he left to join the Bituminous Coal Division at Washington as technical advisor to the Office of Consumers' Counsel. He rejoined the company as Philadelphia district sales manager in March, 1940.

EDWARD T FISHWICK, vice-president and director of the Worthington Pump & Machinery Corp., died on March 15 at his home in Glen Ridge, N. J. Mr Fishwick had been with the Worthington organization for 49 years, having started with the corporation at its Cincinnati works. Mr Fishwick was senior vice-president of the corporation.

GETTING THE *MOST* FROM YOUR THERMAL INSULATIONS...



NUMBER 3 in a series of messages to American industry devoted to conserving heat, improving operation . . . and increasing production through modern insulation practice.

Official U. S. Navy Photograph

To hasten the winning of today's battle of production, fuel must be conserved—steam pressures and process temperatures must be maintained. Improvement in boiler plant efficiency that results from using thicker insulation often obviates the necessity for installing additional boilers and equipment. There is no skimping of material when armoring the turret of a battleship. Thicknesses are great enough to fully protect the guns and gunners. Similarly, the thermal insulations which are industries' armorplate against the waste of heat should be thick enough to prevent such losses.

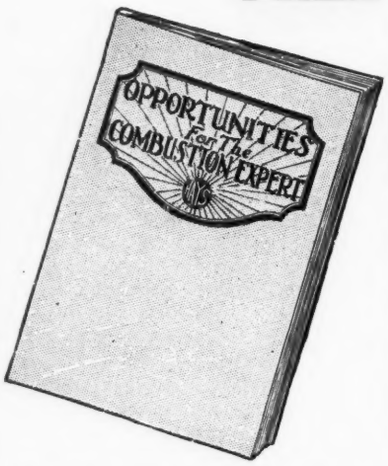
The insulations on your boilers, piping and equipment should be checked at frequent intervals, as a guard against unseen losses. And when insulations are specified for new construction, make sure they are thick enough to really do the job.

★ **EHRET'S 85% MAGNESIA** and other Ehret heat insulating materials are fully treated from the standpoint of characteristics, selection and application in a new 176-page Heat Insulation Handbook. It will be sent, without obligation, to anyone interested in getting the most from thermal insulations. Write for your copy of Handbook A205

EHRET MAGNESIA MANUFACTURING CO.
VALLEY FORGE, PENNA.

...THERE IS AN *EHRET* DISTRIBUTOR OR CONTRACTOR IN EVERY INDUSTRIAL AREA

This Book is Yours .. FREE



Combustion Efficiency as applied to Boiler Plant Operation, Fuels and Equipment is now a most important factor in Defense work. Fuels cost more than ever before. Boiler loads are heavier. A scarcity of some kinds of fuel is apparent.

The Combustion trained man — the Hays trained man—can do his part, and open up big opportunities for himself that never existed before, by devoting a little of his spare time in training himself to meet present conditions.

How? Through the simple, easy reading, *practical* Hays Home Study Course in Fuel and Combustion Engineering. For 26 years the Hays Institute has specialized exclusively in training in Combustion Efficiency. Hundreds of Hays trained men now hold substantial positions of responsibility. What we have done for them we can do for you, in your spare time.

Just a Few of Our Hundreds of Friends

International Harvester Co..20
Armour and Co 75
Combustion Engineering Company 45
Riley Stoker Corp. 75
Iron Fireman Mfg. Co.....35
Commonwealth Edison Company 145
State of Illinois.85
Cities Service (Oil & Power).70
–and many others—

Many companies urge their men to enroll. They know the value of Hays Combustion Training.

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The coupon below will bring you, without expense, full particulars regarding the Hays short, practical, easy reading, home study Course in Combustion. Do your part by starting now to train yourself in the uncrowded wide open field of Fuel and Combustion Engineering. Hays trained men are in demand, today more than ever. Send the coupon Now. No obligation of course.

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Please send me your Free Book "Opportunities for the Combustion Expert"—No Obligation.

Name .....

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City..... State.....

Company Name.....

PERSONALS

J B COLESWORTHY has been appointed Los Angeles district sales representative of the Crocker-Wheeler Electric Manufacturing Co, Ampere, N. J. Mr Colesworthy will handle the sales of all the company apparatus in southern California, Arizona, and southern Nevada. His headquarters will be 1709 West 8th St, Los Angeles, Calif.

CHARLES D CAVETT has been appointed advertising and sales promotion manager of the Cummins Diesel Engine Corp, 1120 Leggett Ave, New York. Mr Cavett has been on the copy staff of Spencer W Curtiss, Inc, for the past three years, and prior to that time was engaged in newspaper and publicity work in Ohio, California and New York.

OSBORNE BEZANSON, general manager of the Texas division of Monsanto Chemical Co, was elected a vice president of the company at the regular monthly meeting of the board of directors. All other officers were reelected. He was employed by the Merrimac Chemical Co in Everett following his graduation from high school. After four years as a laboratory assistant he was made a department superintendent in 1910, continuing in this position until 1918 when he was made assistant to the president. Later he was made works manager and vice president. In 1929, after the Merrimac Co was taken over by Monsanto, he was promoted to the position of production manager of the Merrimac division. Early this year he was made general manager of the Texas division.

R L KIRKPATRICK has been made manager, renewal parts section, Westinghouse Electric & Mfg Co. Mr. Kirkpatrick joined the company in 1922, when he was 16. Entering Westinghouse Technical Night School immediately, and received his engineering certificate in 1926. Starting as a tool grinder, Mr Kirkpatrick moved into the cost department in 1924 and into the renewal parts section, as a price clerk, in 1925. Since that time he has received experience in all phases of renewal parts work.

GORDON L CRAWFORD, previously sales manager of the Buffalo district of Wickwire-Spencer Steel Co, has been appointed assistant general sales manager with headquarters in New York. Mr Crawford will continue as sales manager of the company's structural

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STEAM • COLD WATER • BOILER FEED

POWER

• CONDENSATE • EVAPORATE •

PLANT

• AIR • GASES • CORROSIVE LIQUIDS •

METERS

Type MS Meters for service as a flow indicator, recorder, indicator and recorder, indicator and totalizor, recorder and totalizor, or indicator, recorder and totalizor.

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6780 UPLAND STREET, PHILADELPHIA, PA.

Your shoes and *Ours*

You must have steel to do your part for Victory.

To take care of your needs, our plants are running day and night at capacity. Our men and women are AT WORK. We are busy producing our share of steel that America must have.

Is there enough steel for Victory? We say--Yes. We believe the nation's present difficulties with this critical material will be solved by cooperation between all users and producers, as partners for Victory.

When we at Youngstown look at your needs for steel, we try to put ourselves into your shoes; when you view the producer's problems, won't you try our shoes?

THE YOUNGSTOWN SHEET AND TUBE COMPANY
YOUNGSTOWN, OHIO

25-32E

How To Save Fuel Oil

Get Maximum BTU's... More Steam... Cut Cost

Fusol removes carbon from preheating unit . . . . eliminates sludge from oil tank . . . . keeps entire system free of carbonaceous materials. Better atomization and hotter flame result from uniform oil. Non-injurious to metals. Fusol must work or you don't pay. Write for information.

MAXFAL CHEMICAL CO... 33 W. 42 St... N.Y.C.

FOR POWER AND PROCESS STEAM

HI-TEST KEWANEE

A quick steaming, ***all-welded*** portable boiler, economical to handle.

Refractory lined firebox and two-pass tubes are easy on the fuel bill. 6 Sizes, 50 to 150 H.P.

125-lb. and 150-lb. steam working pressure.

For 6" rule with scale for reading pipe sizes, write Dept. 89K-V.

KEWANEE BOILER CORPORATION
KEWANEE, ILLINOIS

BETTER SERVICE — SAFETY — SATISFACTION
FOR REPLACEMENTS ORDER

Mica Shields Protectors

PRECISION GAGE GLASSES and GAGE GLASS GASKETS THAT WILL NOT BLOW OUT

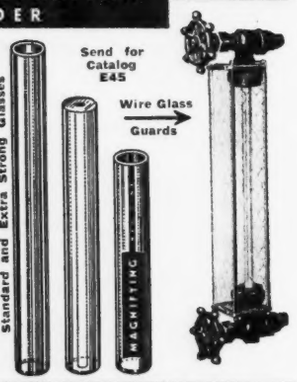
Standard Square Cut Gaskets High Pressure Non-hardening and Non-softening

GASKETS THAT WILL FIT EXACTLY

Red Lip-mold Pattern Expansion Type Gasket

Send for Glass and Gasket Chart

Shipment made by parcel post the same day as order is received



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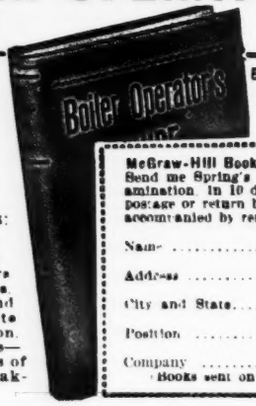
Wire Glass Guards

ERNST WATER COLUMN & GAGE CO.
RUBBER & GLASS DIVISION LIVINGSTON, NEW JERSEY

THIS NEW **BOILER OPERATOR'S GUIDE** . . . can mean money to you!



JUST OUT! Here's information of the most priceless sort for you — whether you want to improve your ability as an inspector or to utilize effective inspection methods in the more efficient, safer operation and upkeep of your own boilers.

Helps you meet everyday problems: Prepares you for license exams

With hundreds of typical examination questions and answers as well as complete instructions, this book presents fully and plainly the things you want to know about proper installation, operation, and care of boilers—the things that prevent dollars of loss in reduced efficiency, breakdown, or even accident.

By H. M. Spring, Jr. 353 pages, 6 x 9 241 illustrations **$3.00**

EXAMINE A COPY FOR 10 DAYS ON APPROVAL

McGraw-Hill Book Co., 330 W. 42nd St., N. Y. C.
Send me Spring's Boiler Operator's Guide for 10 days' examination. In 10 days I will send you $3.00, plus few cents postage or return book postpaid. (We pay postage on orders accompanied by remittance.)

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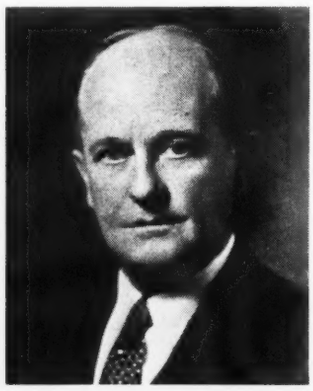
products division. Mr Crawford became a salesman for Wickwire in Feb 1927, in Chicago, serving there and in Tulsa until 1935, when he was transferred to the New York sales office. He became district sales manager of the Buffalo district in May, 1940.

COL WILLIAM KELLY, president of Buffalo, Niagara & Eastern Power Corp, was elected president of Buffalo-



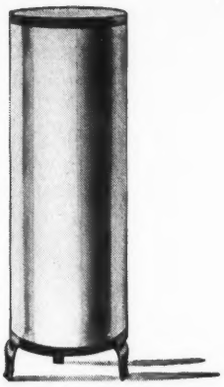
Niagara Electric Corp at a meeting of the board of directors of the corporation. He succeeds the late Horace L Mann who died recently.

FRANCIS J SILL, consulting engineer of Westboro, Mass., announces the removal of his office to Boston and the formation of a partnership with K R Warrington. Mr Warrington is well known in engineering circles in New England and has been associated with Mr Sill for twelve years. The address of Sill & Warrington will be 211 Congress St, Boston, Mass.

JOSEPH T WRIGHT has been appointed manager of the compressor and tool division of the Holyoke, Massachusetts, works of the Worthington Pump & Machinery Corp. Mr Wright served as assistant works manager of Lodge & Shipley Machine Tool Co during the first World War, subsequently organized the J T Wright Co of Cincinnati, which subsequently merged with Harris-Seybold-Potter Co, Dayton, Ohio.

CHARLES P GILIKSON, former factory representative at Minneapolis for American-Marietta Co, has been named assistant to Roland G Maus, sales manager. He joined the industrial paint firm four years ago, coming from the Minnesota Mining & Manufacturing Co. He will make his headquarters at the company's main office in Chicago.

S L BATES has been appointed Buffalo district sales manager of the Wickwire-Spencer Steel Co, 500 Fifth Ave,



The *Everdur* that might have made this tank...

Instead—

made screws to fasten the hull of a power-ful PT boat

It takes a *stout* metal for the job of fastening a wooden hull that is unbelievably stressed and strained as it pounds swiftly over wave-capped seas. Everdur* is strong, yes, and corrosion-resisting too. These qualities are essential, but so is toughness and malleability—freedom from brittleness. For these very reasons, Everdur has long been used for screws and bolts and water tanks and countless other things. These are also some of the reasons behind today's unprecedented demand for Everdur copper-silicon alloy.

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from mine to consumer

*Trade-mark of The American Brass Company, Reg. U. S. Pat. Off. 4265

Everdur COPPER-SILICON *Metal*

THE AMERICAN BRASS COMPANY— General Offices: Waterbury, Connecticut

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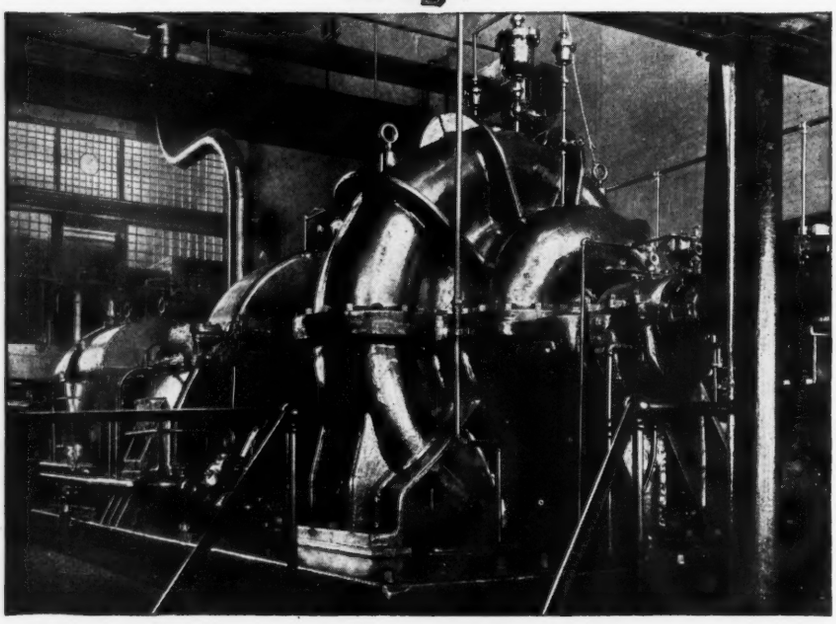
For LARGE Capacities OR SMALL . . .



WARREN PUMPS

ARE BUILT TO FIT THE JOB

Whether a pumping job calls for *tremendous* capacities or small ones, you can count on Warren Pumps to give dependable, long and low-cost performance. *Every* Warren Pump is built to fit the job . . . with *no compromising* with sound engineering principles.

All Warren Pumps have good details. They have liberal clearances that insure highest practical efficiencies and low power costs, year after year. They have extra heavy shafts that minimize internal wear . . . over-size bearings . . . broad-faced case rings . . . properly proportioned liquid passages.

To help us "do the impossible," as Mr. Donald Nelson says that we *must* do—call on Warren Pumps for uninterrupted service.

WARREN STEAM PUMP COMPANY, INC.
WARREN, MASSACHUSETTS

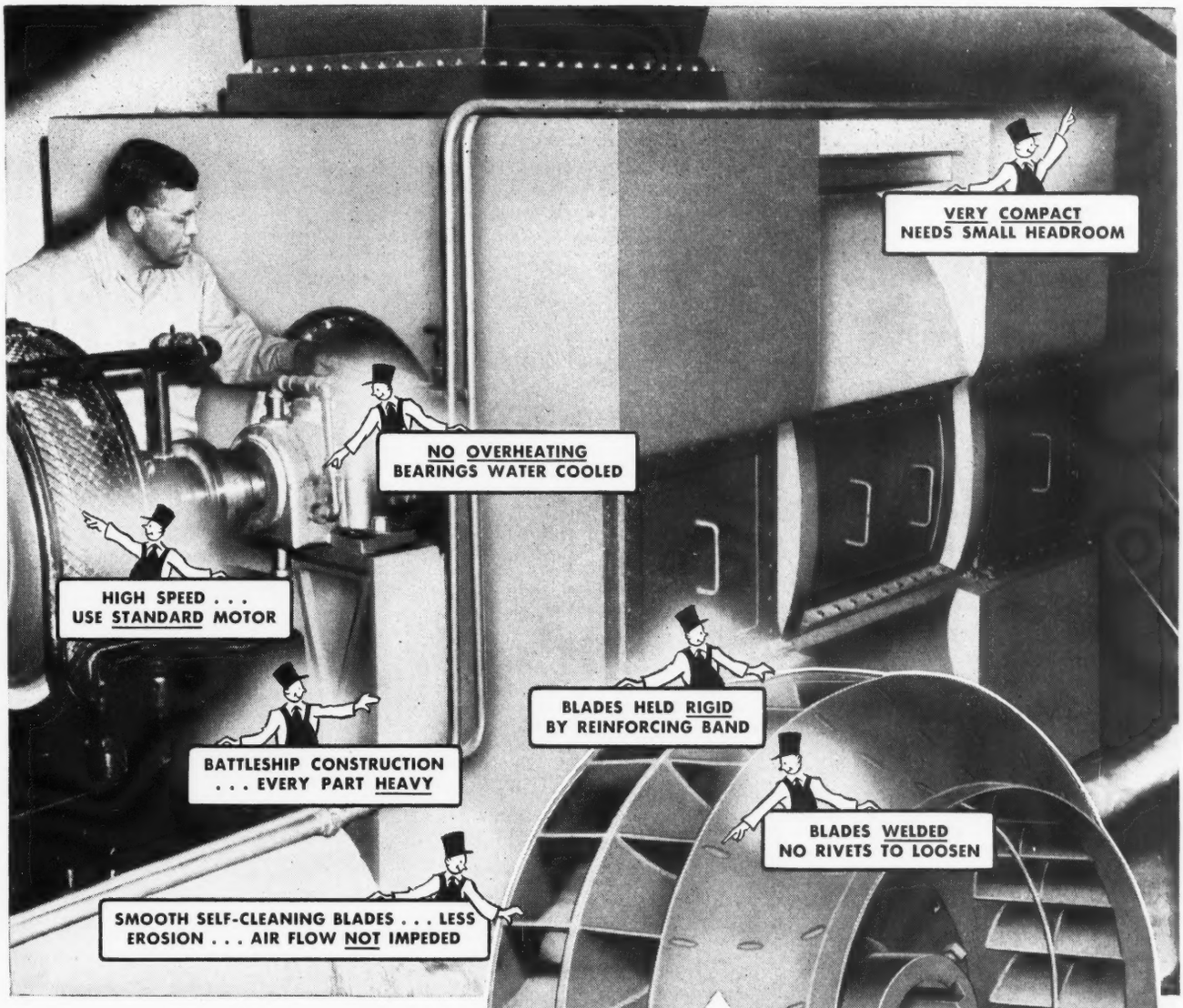
New York, N. Y. Prior to joining Wickwire-Spencer, Mr Bates was secretary and assistant treasurer of the Beans Spring Co, Massillon, Ohio. He had previously served as purchasing agent of the National Pressed Steel Co, and has been associated directly and indirectly with the steel industry since 1918.

W S PARRISH has been appointed sales manager of the newly enlarged midwest division of the Iron Fireman Manufacturing Co, Portland, Ore. Starting with Iron Fireman as a retail salesman, Parrish later had experience as an Iron Fireman dealer in Champaign, Ill. He then served as a district salesman, and was later promoted to

district representative in the Indiana-Illinois territory, an assignment which he filled for a number of years. Appointed district sales manager of the midwest district three years ago, he occupied that position until his recent promotion to midwest division sales manager.

J D VAN VALKENBURGH has been appointed assistant to the president of Irvington Varnish & Insulator Co, Irvington, N. J. For the past several years Mr Van Valkenburgh has been associated with the Johns-Manville Corp, New York.

GEORGE L KNIGHT, assistant vice-president of construction and shops, and a vice president of the Brooklyn Edison Co, retired recently after 40 years of service. In 1902, two years after he was graduated with a degree in electrical engineering from the Drexel Institute, in Philadelphia, he started as a draftsman with the New York Edison Co, and soon was assigned to design work for the completion of the mechanical installation at the Waterside generating station. As a result of this job he was called across the river to become chief draftsman of the Edison Electric Illuminating Co of Brooklyn, predecessor of the Brooklyn



What CLARAGE Has *is Vital Now!*

Power — and MORE POWER — to meet the needs of war-time production!

Now every item of power plant equipment *must* "deliver the goods" every minute of every 24-hour day — be able to handle peak loads for long stretches.

Fully able are the mechanical draft fans — Type RT shown above — built by Clarage. *They have what it takes!* . . . modern design to provide high speed, economical operation . . . battleship construction and dynamically balanced wheels to assure smooth, long-time performance under the most trying conditions.

No wonder so many hundred industrial power plants and central stations are Clarage equipped! It will pay you, too, to investigate.

CLARAGE FAN COMPANY—KALAMAZOO, MICH.
SALES ENGINEERING OFFICES IN ALL PRINCIPAL CITIES

COMPLETE
AIR CONDITIONING
•
COOLING
•
VENTILATION
•
FACTORY HEATING
•
MECHANICAL DRAFT
•
FANS and BLOWERS
for
INDUSTRIAL NEEDS

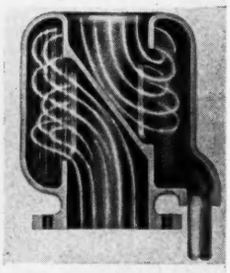
In more than
12,000 Plants
COCHRANE
MULTIPORT
RELIEF VALVE

Cochrane Multiport Back Pressure Relief Valve with front and back plates removed.

Successful operation of the Cochrane Multiport Valve in more than 12,000 plants is a sure guarantee of its continuously reliable operation. This continuous operation is insured by the multiport principle — a number of small discs instead of one large disc, eliminating the sticking, jamming and freezing common to single-disc valves in the control of atmospheric relief, back pressure, etc.

Call your Cochrane representative or write for further details.

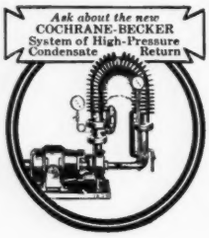
COCHRANE Exhaust Head



Designed to separate condensate and oil from steam discharged to atmosphere and thereby prevent raining of water and oily condensate on the roof, Cochrane Exhaust Heads incorporate a highly efficient free-flowing baffle type construction and an exceptionally large port area which minimizes back pressure. Write for further details.

COCHRANE CORPORATION
3106 N. 17th St., Philadelphia, Pa.

Rapidly removes hot condensate from steam process equipment and returns it to boiler at high pressure and close-to-process temperature. IMPROVES QUALITY, INCREASES PRODUCTION, CUTS COSTS.



Edison Co. He was made design engineer in 1905. He was appointed mechanical engineer in 1923, and nine years later was elected vice-president in charge of mechanical operations. He became a vice-president and engineer of construction in 1939. In 1940 Mr Knight became an assistant vice-president of Consolidated Edison for construction and shops. He also continued as a vice-president of the Brooklyn Edison Co.

BUSINESS ITEMS

WESTINGHOUSE ELECTRIC & MFG CO announces several personnel changes. B W Clark, vice-president in charge of the merchandising division, was appointed vice-president in charge of sales of the company. He succeeds Ralph Kelly, who resigned to become executive vice president of the Baldwin Locomotive Works. Mr Clark, in addition to supervising the sale of apparatus, will be responsible for coordinating all sales of the Westinghouse Co and its subsidiaries. JOHN H ASHBAUGH, manager of the manufacturing and engineering section of the merchandising division since Nov 1941, was appointed manager of the division with headquarters in Mansfield, Ohio. Prior to his appointment as manager of manufacturing and engineering of the merchandising division last fall, Mr Ashbaugh had been acting manager of those activities at Mansfield and Springfield, Mass., since Jan 1941. Mr Ashbaugh started with Westinghouse in 1918 as a student engineer in the East Pittsburgh works of the company.

THE BIRD-ARCHER CO announces the appointment of Tesco Chemical Co, Atlanta, Ga., as their Southeastern representative. The six sales engineers employed by Tesco cover the Carolinas, eastern Tennessee, Georgia, Alabama and Florida.

F C BOYCE was re-elected president of the D J Murray Mfg Co., Wausau, Wis., at the annual meeting of the board of directors in March. M P McCullough, Chicago, was re-elected vice-president; J S Alexander and C E Staky, both of Wausau, were again re-elected treasurer and secretary, respectively. Mr Staky is general manager of the company. In addition to the officers named, D C Everest, W L Edmonds and Grover Keeth are directors of the company.

Fyr-Feeder

"Best Stoker Built!"

HUNDREDS of users of the "up-to-the-minute" multiple FYR-FEEDER praise the EFFICIENT, DEPENDABLE, ECONOMICAL service they have been getting ever since changing over to this *most* modern firing system. Engineers say it's the best and finest stoker built and you will agree with them if you install it under your boilers. Why go on with "out-of-date" firing methods when you can have the Multiple FYR-FEEDER Spreader Stoker do a wonderful job for you?

- **Simple, automatic, foolproof! BURNS COAL LIKE OIL!**
- **FYR-FEEDER means less work for the fireman. Makes firing automatic and E-A-S-Y! Takes all the hard work out of cleaning fires —no clinkers to struggle with—no slice bars need be used.**
- **FYR-FEEDER increases boiler steaming capacity. FYR-FEEDER burns cheapest coal at highest efficiency. FYR-FEEDER uses local coals and saves VITAL transportation facilities now so urgently needed in the War effort. FYR-FEEDER reduces smoke because it produces accelerated or "instant" and perfect combustion.**

FYR-FEEDER does a perfect firing job with never more than an average of ½" of coal on the grate.

FYR-FEEDER will help you cut your steam costs. Wire your order for FYR-FEEDER today, or write today for full details.

TERRITORIES FOR SALES ENGINEERS
Some territories are open for experienced sales engineers familiar with steam plant boilers and furnaces. Information on request. Please furnish record of your experience and references.

AMERICAN COAL BURNER COMPANY,
Engineers
32-18 East Erie St., Chicago, Ill.

☐ YES, I want to know what the FYR-FEEDER can do in our plant.
☐ Please mail descriptive literature.
☐ I am interested in selling FYR-FEEDERS.

Name .....
Company .....
Address .....

BELMONT PACKINGS

Use the Belmont Packing Catalog to Solve Your Packing Problems

Save time.. GET RESULTS

ed Asbestos

mont 185—Spiral-Belmont 188

Coil-Belmont 189

netration which is accelerated as the tem-

This braided asbestos packing is specially penetration and saturation are minimized. cold or hot, you can guard against seepage rial by installing Belmont Asbestos Packing and plungers. We particularly emphasize t service rendered when temperatures are at he packing is literally "boiled in oil".

ON: Long fibre asbestos yarn, braided jacket ch strand treated with a special compound, ted and graphited. This packing is constructed pillary attraction and saturation. Supplied in sizes 1/8" and upward.

N: Cold and hot oil rods and plungers.

nd Contents of Standard Sizes

f Feet Per Spiral or Coil
Column C—Approximate Weight Per Box in Pounds

3/16"			1/4"			5/16"			1"		
B	C	A	B	C	A	B	C	A	B	C
14	3 1/8	1	14	4 3/8	1	14	5 1/8	1	14	6 1/8
31	8	1	24	8	1	22	10	1	19	10

data is given for estimating purposes only.

PAGE 25

"6100" GASOLINE PACKING

Spool-Belmont 6100—Coil-Belmont 6102

Ring-Belmont 6101

Belmont "6100" Packing is made especially for use on rods and valve stems handling distillates such as gasoline, naphtha, kerosene and benzol. Such solvents have a tendency to break down ordinary lubricants. This packing is lubricated under our own formula to retain softness and essential sealing qualities when applied against volatile distillates. It is particularly effective in that it eliminates the constant fire hazard of leaky stuffing boxes. The acceptance of Belmont "6100" by many of the largest oil refineries throughout the world is the best testimony of the superiority and safety of this packing.

CONSTRUCTION: High grade asbestos yarn, braided jacket over jacket, each strand of asbestos thoroughly impregnated with a compound especially prepared for use against oil, gasoline, naphtha, kerosene and benzol. Square cross section. Belmont 6100 is supplied in 1 lb., 3 lb. and 5 lb. spools in sizes 1/8" to 3/8" inclusive, securely boxed.
Belmont 6102 is supplied in flat boxes in sizes 7/16" and over. If desired, however, smaller sizes than 7/16" can be supplied in flat boxes under Belmont 6102.

APPLICATION: Piston rods and valve stems running in oil, gasoline, benzol, naphtha, kerosene.

Note: For Rotary service against oil, gasoline, benzol, naphtha and kerosene, we recommend Belmont square braid (like Flax). Ring Form-Belmont 6105, Coil Form-Belmont 6106.

Table of Approximate Box Weights and Contents of Standard Sizes

Column A—Number of Spirals or Coils Per Box
Column B—Approximate Number of Feet Per Spiral or Coil
Column C—Approximate Weight Per Box in Pounds

Belmont Style	1/4"			3/8"			1/2"			5/8"			3/4"			7/8"			1"		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
Coil 6102	1	121	5	1	54	5	1	60	8	1	37	8	1	28	8	1	26	10	1	21	10
Coil 6106	1	120	5	1	52	5	1	49	8	1	37	8	1	24	8	1	23	10	1	19	10

Box weights and contents are not guaranteed. This data is given for estimating purposes only.

NOT JUST ANOTHER CATALOG—but a packing reference book prepared by packing engineers. 84 pages of packing information, all reduced to its simplest form; with each and every type of Belmont packing clearly illustrated and described—as shown in the facsimile page above.

The Belmont Packing Catalog includes recommendation charts that enable you to check instantly, by type of service, Belmont's choice of packing styles (listed in the order of our selection). Packing end views are pictured in large size showing minute details. Construction, applications, tables of weights and measures are all laid out in easily readable form so that everything can be taken in at a glance.

The Belmont Packing Catalog is a time-saver, a book you should not be without. Write on your Company letterhead for your copy today.

There's a Belmont Packing for every service: Steam, Water, Oil, Gas, Air, Acid, Alkalis, Ammonia. Forms include: Rings, Coils, Spirals, Reels, Spools, Sheets, Gaskets. Whatever the need, Belmont has it.

Belmont Packings are Sold by Authorized Belmont Distributors in Every Large Industrial Center.

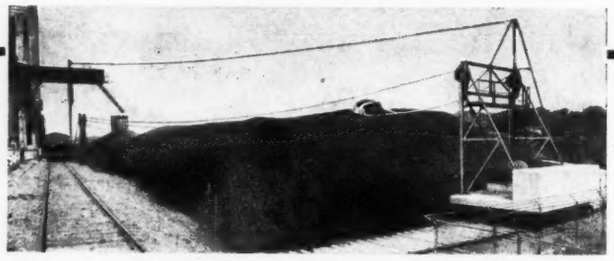
THE BELMONT PACKING & RUBBER CO.

Dept. P-542

Butler and Sepviva Streets • Philadelphia, Pa.

Coal Storage Simplified

with an economical SAUERMAN SCRAPER



ENGINEERS and superintendents of power plants large and small where coal is being stored and reclaimed with SAUERMAN Power Scrapers say that this equipment is giving them a maximum of satisfaction.

These machines operate rapidly and economically—handling coal into and out of storage in any required capacities. Coal is piled layer on layer (to 40 ft. heights) and the constant movement of the scraper across the pile packs the coal tightly so that there are no air pockets, hence no chance for spontaneous combustion. To change the operation from storing to reclaiming takes only a few minutes.

The operator is housed in a comfortable control station where he has a view of the entire storage area. The operation is completely automatic.

Write for interesting catalog to

SAUERMAN BROS., Inc.
562 S. Clinton St., Chicago

SAUERMAN

POWER SCRAPERS **FOR COAL STORAGE**

How to analyze and correct troubles of any type oil burner DOUBLE-QUICK

C. H. CHALMERS
Pres., Chalmers Oil Burner Co.; Former Pres., American Oil Burner Assn., says, "No one installing or servicing burners should neglect to read this well-written and informative manual."

Today's money-making opportunities in oil burner servicing are keyed not only to how well the work is done but how fast. With this practical book you can locate, diagnose and correct all operational and constructional troubles of any type or recognized make burner without delay or doubt—and thus increase earnings.

OIL BURNER SERVICE MANUAL

By **K. STEINER**
Consulting Engineer, Ray Heat & Power Co.
and **F. RAVNSBECK**
Chief Engineer, Ace Engineering Co.
365 pp., 6x9, illus., $4.00

Gives the mechanic just the help he needs in installing and servicing oil burners, in plain language. Exhaustive treatment given to domestic burners, including all recognized makes from earliest to current types. Commercial and industrial installation, maintenance and service are thoroughly discussed and illustrated. Gives countless pointers secured from men actually engaged in handling the various burners and accessories.

16 CHAPTERS COVER:

- Domestic Pressure-atomizing Oil Burners.
- Domestic Vertical-cup Burners.
- Rotary Wall-flame Burners.
- Low-pressure Atomizing Domestic Burners.
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- Horizontal-rotary Oil Burners.
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- Refractories.
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- Service.

MAIL COUPON FOR 10 DAYS' FREE TRIAL

McGraw-Hill Book Co., 330 W. 42nd St., N. Y. C.
Send me Steiner and Ravnsbeck's Oil Burner Service Manual for 10 days' examination on approval. In 10 days I will send $4.00 plus few cents postage, or return book postpaid. (Postage paid on orders accompanied by remittance.)

Name .....
Address .....
City and State .....
Position .....
Company P-5-42

At a recent meeting of the board of directors of the ERIE CITY IRON WORKS, Erie, Pa., Edward C Moore, for many years vice-president and treasurer of the company, was elected chairman of the board. He will also continue to be the treasurer. Frank G Brinig, who has been general manager since 1933, was elected president, and will also continue as general manager. Mr Dudley Selden, secretary and sales manager, was elected vice-president and will continue as sales manager. Mr Edward Selden, a member of the board of directors, was elected secretary. John D Clemens was elected to the board to succeed his father, the late Hays H Clemens, who had been president since 1924.

At the annual meeting of the NATIONAL ASSOCIATION OF FAN MANUFACTURERS held in Detroit, the following officers were elected for the ensuing year: J M Birkenstock, president; Edgar F Wendt, vice-president; and L O Monroe, secretary-treasurer. At the same time the Association celebrated its 25th anniversary, having been organized in 1917.

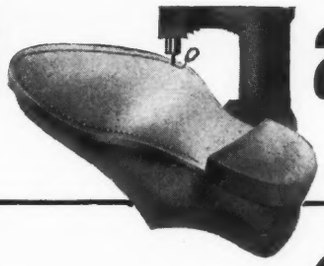
POWER SPECIALTY Co, Houston, Tex., has been appointed to represent the Cochrane Corp in southeastern Texas. In addition to representing the Cochrane Corp, the Power Specialty Co also handles the products of Centrifix Corp, Erie City Iron Works, Hays Corp, J E Lonergan Co, and the Lummus Co.

THE ACOUSTIC DIVISION of BURGESS BATTERY Co announces a change of address to 2815 West Roscoe St, Chicago, effective March 30.

THE EDWARDS Co has announced the purchase of the Hill Diesel Engine Co, Lansing, Mich. Heading the new Hill management as president is Ralph B Rogers, New York, who is also president of the Edwards Co. R E Olds remains as chairman of the board of directors.

BAILEY METER Co has enlarged its field engineering staff. The following engineers have recently been assigned to field duty: J T Elder and J E Wood to Atlanta; J E Luppold to Seattle; E P Nye to Buffalo; R B Pogue to Milwaukee; W D Hilborn to Houston; J J Haslam to Kansas City; J J Wilber to Cleveland; C E Hicks to New York; J R Powell to Pittsburgh; S G Dukelow to Denver; R V Johnson to Chicago; W D Robinson to Boston, and C C Holtzman to Philadelphia.

Give it a New Wearing Surface

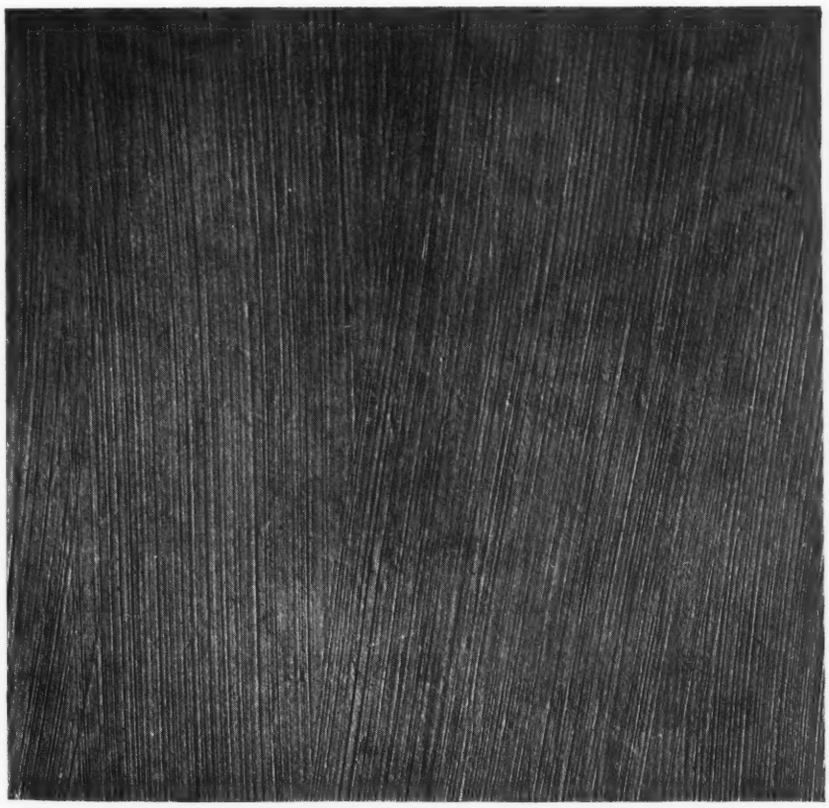


APEXIOR

ADDS EXTRA LIFE TO BOILER METAL

No one, in times like these, overlooks any chance to renew the life of valuable possessions — be they shoes or tires.

Prolonged operation of old boilers — even those approaching condemnation — is a proved fact . . . with APEXIOR. If the boiler, when cleaned, can undergo the required hydrostatic test, it can be APEXIORIZED and kept on the line for years.



APEXIOR . . . a Renewable Wearing Surface

APEXIOR No. 1, brush-applied to boiler tubes and drums, adds a long-lasting top-surface to the metal—taking the wear and resisting corrosion. The metal itself is never touched by erosion, corrosion or scale. Scale is prevented from binding—it is easily cleaned off with a wire brush.

The Apexior "skin" is simple to renew. One-coat resurfacing with a hand or rotating brush is all that's needed — every two or three years.

APEXIOR guarantees good metal condition . . . no other protection offers the same assurance and security

Men who demand top efficiency from steam boiler and turbine equipment have used APEXIOR for years—as a supplement to feed-water treatment. In the job of getting peak production from irreplaceable equipment, APEXIOR should be given your full consideration.

ECONOMIZE . . .

APEXIORIZE

APEXIOR
REG. U.S. PAT. OFF.

THE DAMPNEY COMPANY OF AMERICA

PROTECTIVE COATINGS FOR STATIONARY BOILERS, LOCOMOTIVES AND STEAMSHIPS

HYDE PARK · BOSTON · MASSACHUSETTS

Atlanta Chicago New York Detroit Philadelphia

Engineering Sales Representatives — Pittsburgh, Cincinnati, New Orleans, San Francisco, Los Angeles, Portland, Seattle, Phoenix, Denver, Salt Lake City, Dallas, Houston, Vancouver, B. C., Montreal, P. Q., Havana, Cuba, Manila, P. I., Honolulu, T. H., Marine Dept., 114 Liberty Street, New York, N. Y.

There's many a valve on a submarine, a cruiser, a battleship, or a freighter. There's many a valve in a powder plant, a refinery or a power plant. Wherever War Production is in full blast there are valves, and wherever new processes are being used which involve new treatment of the liquids and gases of Industry, new valve installations are being designed and built to handle them.

Twenty-four hours a day, seven days a week, Powell Engineers, Designers and Shopmen are devoting themselves to this task. Behind them is a century of experience, the skill which comes with it and a research engineering laboratory full of up-to-the-minute equipment. The builders of America's ships, refineries and arsenals will not forget Powell's contribution of Valves for Victory.

THE WM. POWELL COMPANY
Cincinnati, Ohio

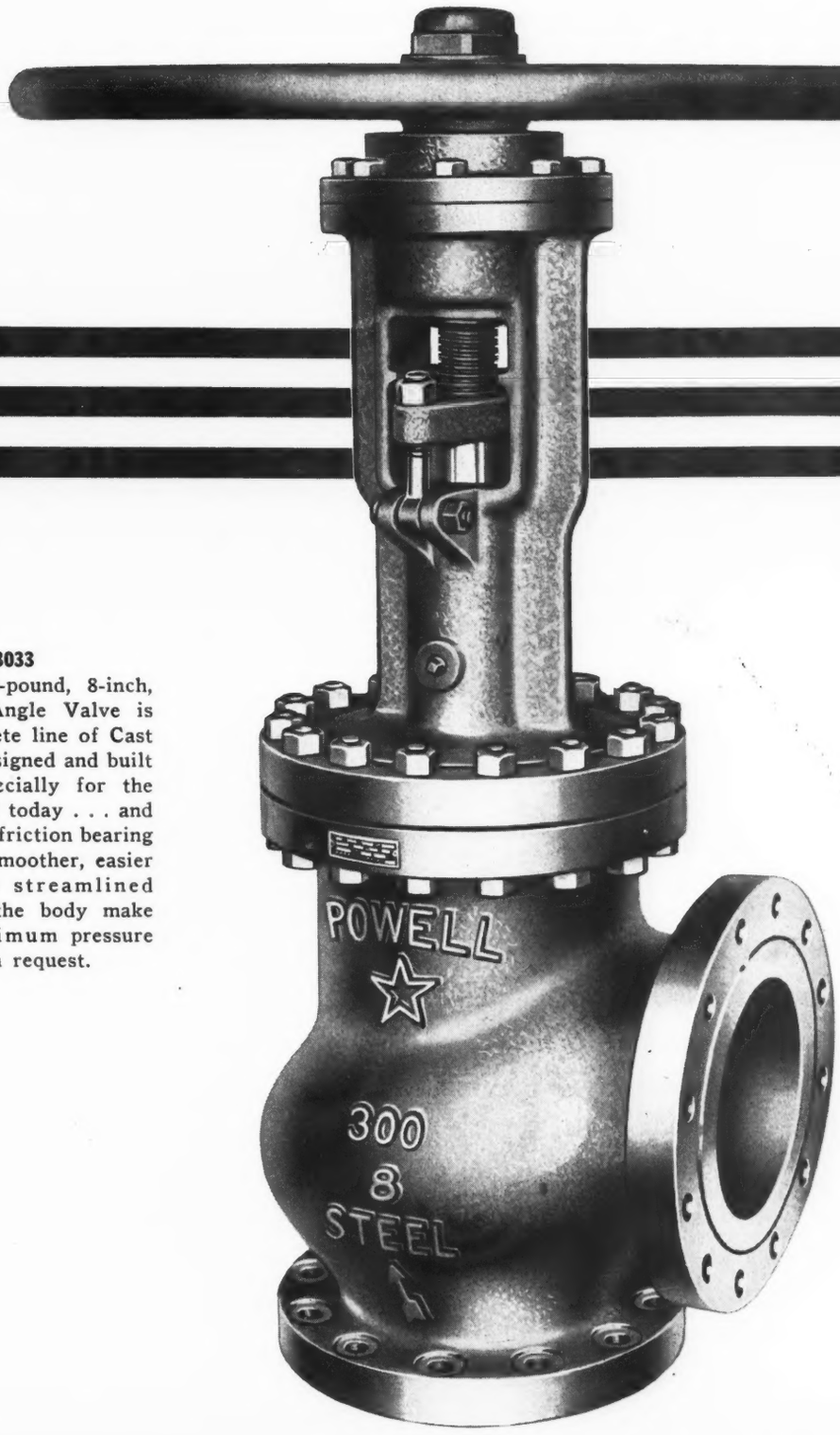
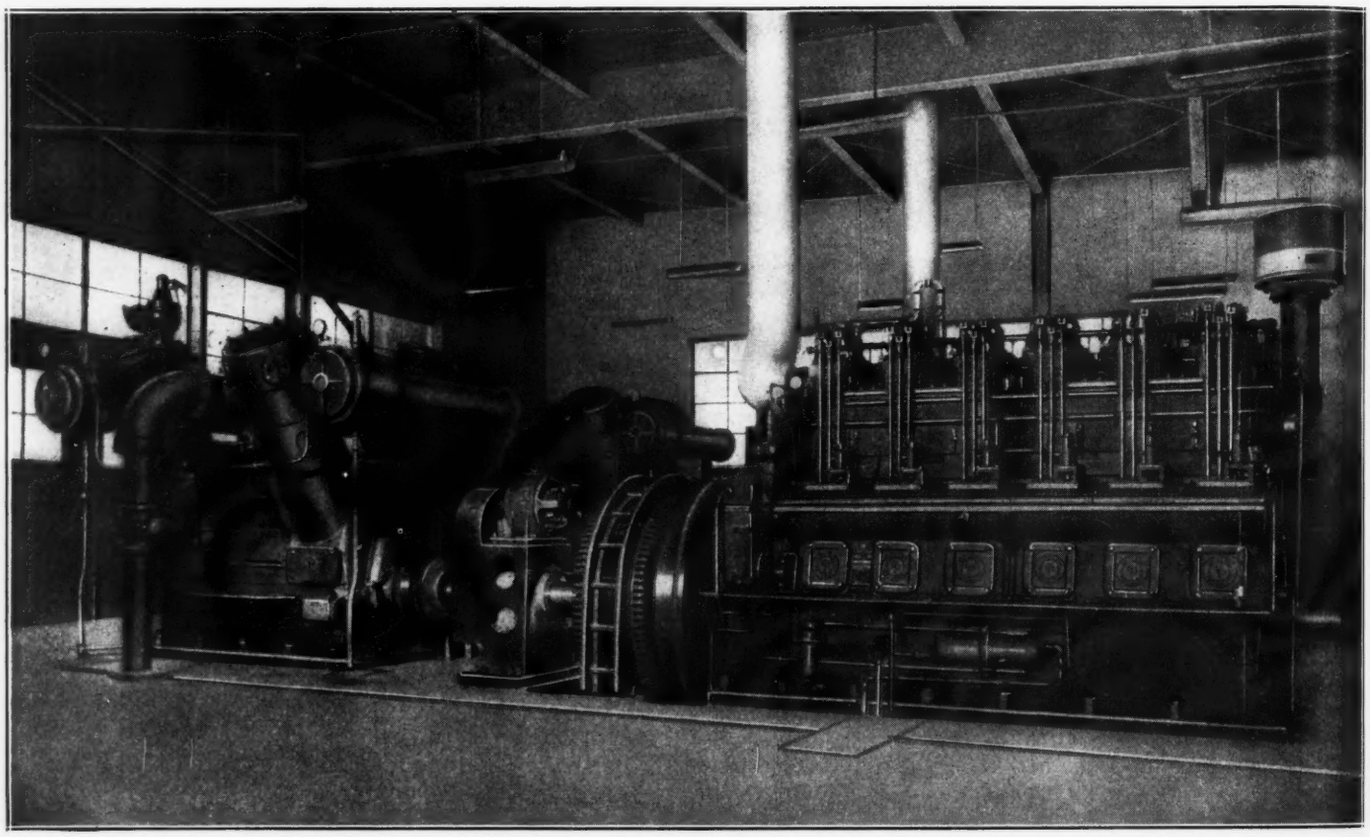


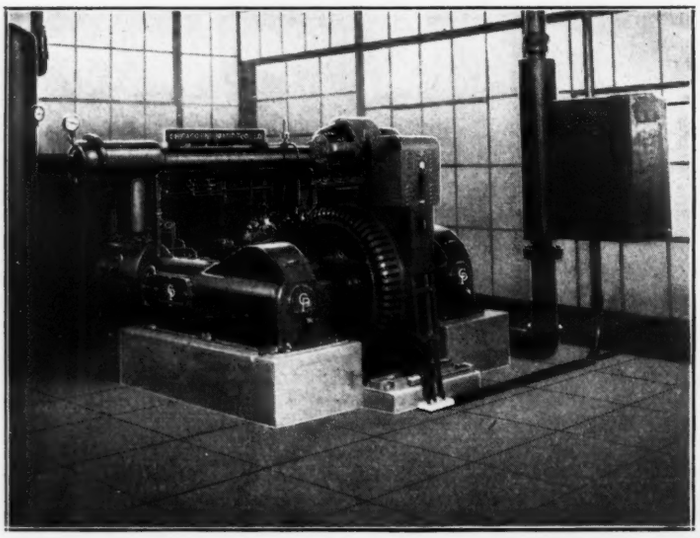
Fig. 3033
This Class 300-pound, 8-inch, Flanged End Angle Valve is one of a complete line of Cast Steel Valves designed and built by Powell especially for the power plants of today . . . and tomorrow. Anti-friction bearing yoke provides smoother, easier operation. New streamlined areas through the body make possible a minimum pressure drop. Details on request.

VALVES

CP AIR COMPRESSORS MEET VARIETY

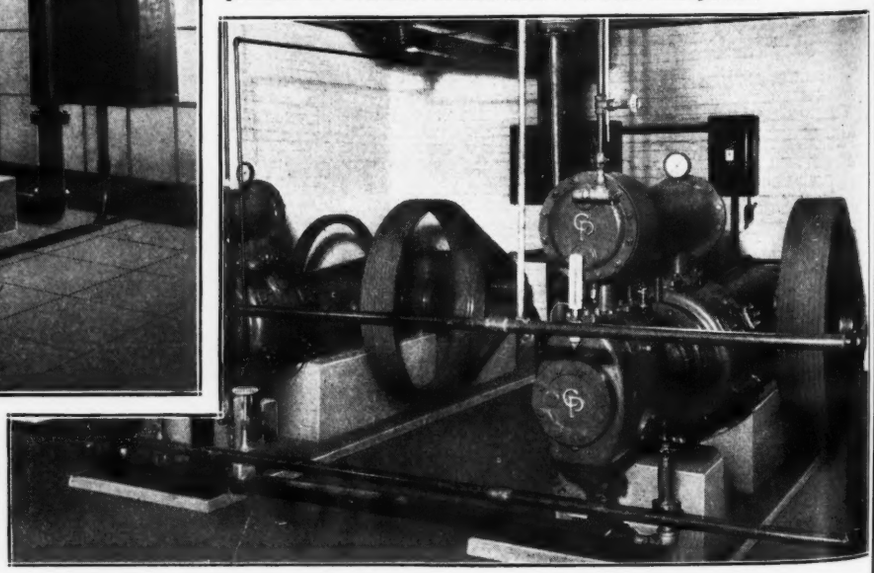


↑ **PROMINENT AIRPLANE PLANT** assured ample air plus power protection with two CP Diesel-driven V-CE compressors. Note generators interposed between compressors and engines for emergency power service. CP vertical double-acting compressors, designed for continuous, heavy duty operation, are available in direct-connected type in 175 to 500 horsepower.



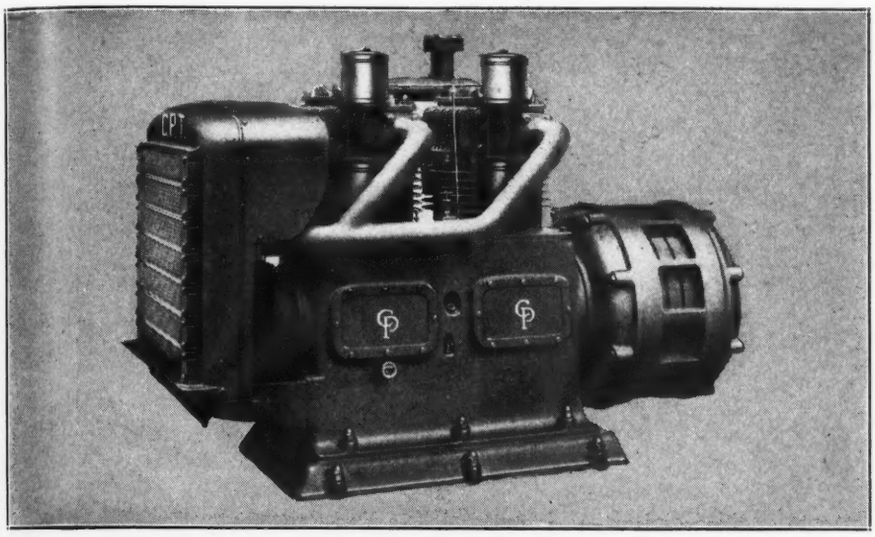
HORIZONTAL, STRAIGHT-LINE TANDEM two-stage → compressors in another airplant plant. Type T-CB Compressors are available in two-stage and three-stage steam and motor-driven models: 20 to 125 horsepower, for pressures up to 2500 lbs. per sq. in.

← **SYNCHRONOUS MOTOR-DRIVEN CLASS O-CE** Horizontal-Duplex Compressor in machine tool manufacturing plant. Simple, efficient, five-step regulation varies the output to meet the load. Synchronous motor-driven class O-CE Compressors are available in sizes from 75 to 1500 horsepower.

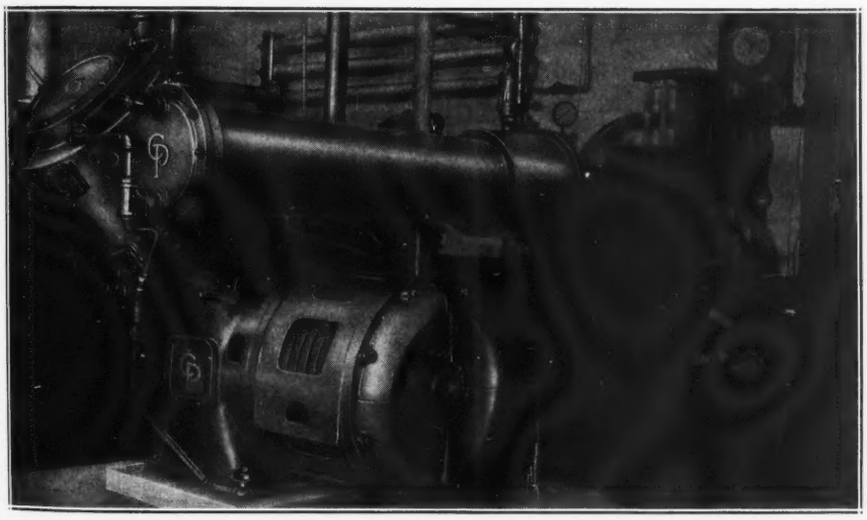


★ ★ ★ ★ CHICAGO PNEUMATIC NEWS ★ ★ ★ ★

OF WAR-TIME PRODUCTION NEEDS



↑ **WHERE FLOOR SPACE IS LIMITED,** the PM-4 is the ideal compressor; compact; low power consumption; two-stage; air-cooled; single-acting; built in electric motor, belt drive or flexible coupling. CP PM-4 Compressors are available in 25 to 75 h.p.



↑ **SHIPPED INTACT,** quickly installed with only a simple, inexpensive foundation, CP Type "Y" Compressor solves the problem of the crowded plant that must have additional air capacity; heavy duty, double-acting type; 75 to 150 horsepower.

BECAUSE OF ITS ANNULAR PORTS and → straight uniform lift, the Simplate valve possesses the greatest effective area for a given valve diameter. Result is low air velocity, minimum valve clearance, low power consumption and high volumetric efficiency.

A TYPE AND SIZE FOR EVERY PLANT REQUIREMENT

Belt, Motor, Steam or Diesel Driven

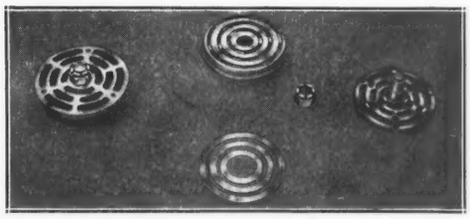
NEW YORK (CP)—The wide range of CP Air Compressors and the diversity of sizes and types are emphasized in recent installations in war-production plants.

An eastern aircraft company installed two CP 1850 cu. ft. Diesel-driven compressors. Another plane manufacturer selected CP synchronous motor-driven horizontal-duplex machines. In smaller plants—and for a number of services in larger industries—the single-acting vertical and horizontal straight line types are filling a varied range of requirements.

Write for data on the complete line of Chicago Pneumatic Air Compressors.

CHICAGO PNEUMATIC TOOL COMPANY

General Offices: 8 E. 44th St., New York, N. Y.



CHICAGO PNEUMATIC

AIR COMPRESSORS

ALSO: Pneumatic Tools, Electric Tools, Rock Drills, Hydraulic Aviation Accessories, Diesel Engines

PORTABLE
STATIONARY
AIR OR GAS
MOTOR DRIVEN
STEAM DRIVEN
DIESEL ENGINE
DRIVEN

It makes the "hard tricks" look easy!

OPERATING men who have had an opportunity to watch the operation of Askania Combustion Control will tell you that it stands distinctly apart. Its ability to meet any load requirement—to operate with the minimum amount of attention—are factors which are important in these times when man-power must be used to the greatest advantage.

An example of this is the installation illustrated above. Two boilers normally burning coke oven gas are controlled to automatically supplement this fuel with oil whenever a deficiency occurs.

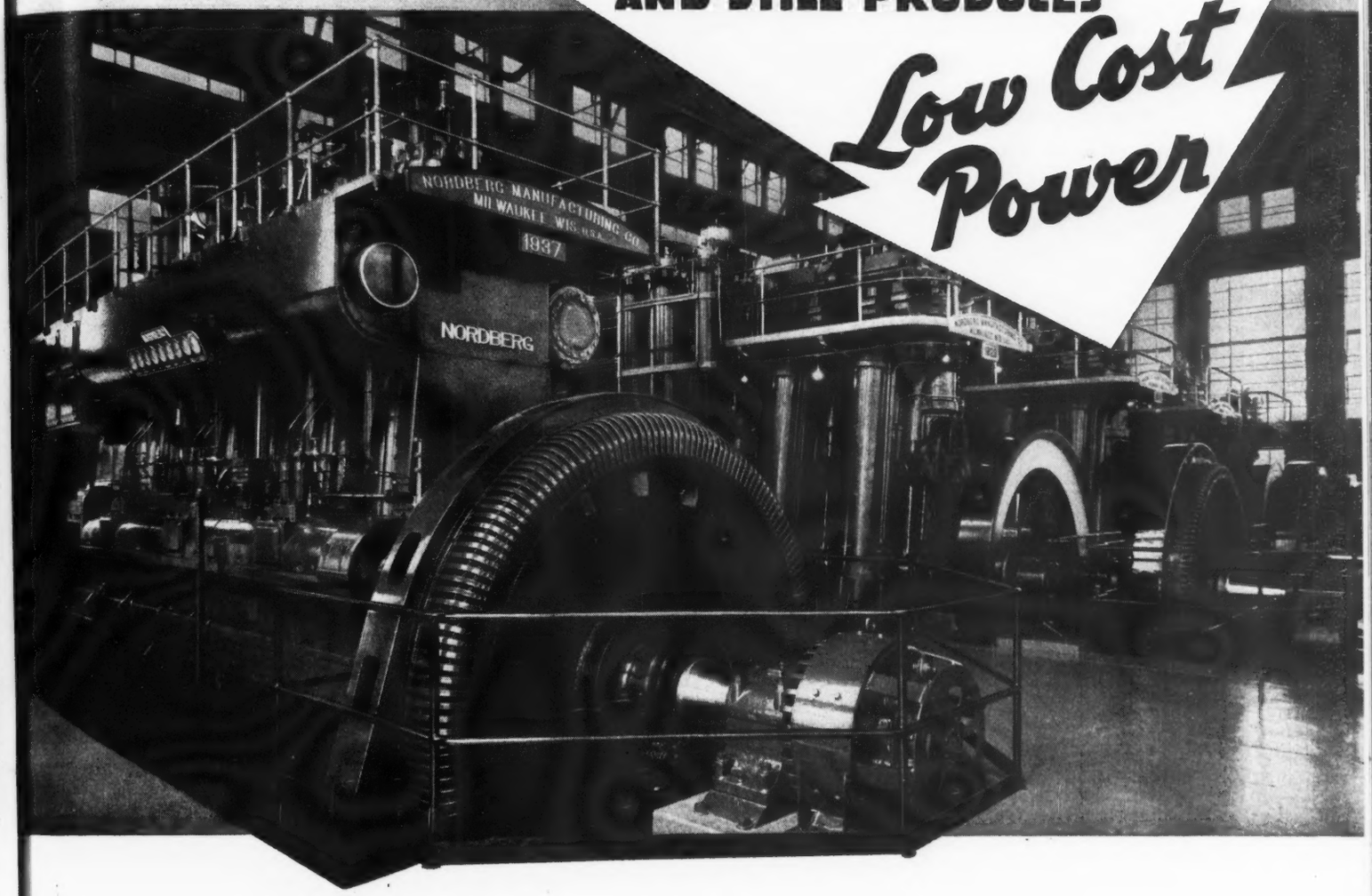
If you have a combustion control problem where the operating conditions are "tough", it is a job for Askania —the control that makes the hard tricks easy.

ASKANIA REGULATOR CO., Corner 16th and Michigan, Chicago, Ill.

ASKANIA
REGULATOR CO. CHICAGO
AUTOMATIC CONTROL

18 years of service-

AND STILL PRODUCES Low Cost Power



THE FIRST Nordberg Diesel Engine installed in the Municipal Plant at Ponca City, Oklahoma, has been in service since 1924 and still carries its share of the load. In eighteen years, this 1250 horsepower unit has generated 44,148,070 K. W. hours. This engine has been burning heavy fuel oil of 8 to 10 gravity during practically this entire period, yet repairs and maintenance have been less than 50 cents per horsepower per year. The original main bearings and piston skirts are still in use and so are three of the original piston heads.

There are five Nordberg Diesels now in the Ponca City Plant; four of 1250 horsepower and one of 2250. The economical and dependable performance of these engines have won for Ponca City nation-wide recognition as one of the few tax-free cities in the country. For the past twelve years, the average total operating cost is only $.00417 per K. W. hour, making this one of the lowest Diesel power cost producers.

Because of the excellent service given by Nordberg Diesels, users continue to place repeat orders when additional equipment is needed. The satisfactory performance at Ponca City, which is typical of other plants where Nordberg Diesels are installed, is best expressed by the following statement of Plant Superintendent Pat Schlesinger:

"Our City is proud of the plant as a whole and the low cost power it produces, but more so of this older engine which, after 18 years of service, still performs perfectly."

If interested in low cost power, write for further information on Nordberg Diesels

NORDBERG MFG. CO., MILWAUKEE, WIS.

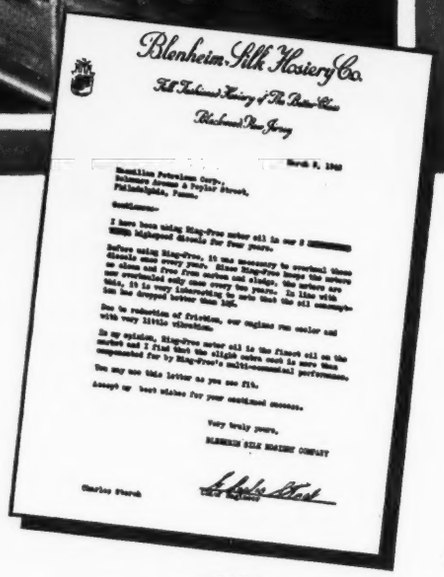
NORDBERG MACHINERY

NORDBERG

DIESEL ENGINES

NORDBERG MACHINERY

What 4 years' use of RING-FREE proved about overhauls and oil consumption


Blenheim Silk Hosiery Co.

Full Fashioned Hosiery of The Better Kind

Blackwood, New Jersey

March 5, 1942

Macmillan Petroleum Corp.,
Delaware Avenue & Poplar Street,
Philadelphia, Penna.

Gentlemen:

I have been using Ring-Free motor oil in our 2 [illegible] Hi-Speed diesels for four years.

Before using Ring-Free, it was necessary to overhaul these diesels once every year. Since Ring-Free keeps the motors so clean and free from carbon, the motors are now overhauled only once every two years. In like with this, it is very interesting to note that the oil consumption has dropped better than 10%.

Due to reduction of friction, our engines run cooler and with very little vibration.

In my opinion, Ring-Free motor oil is the finest oil on the market and I find that the slight extra cost is more than compensated for by Ring-Free's multi-economical performance.

You may use this letter as you see fit.

Accept our best wishes for your continued success.

Very truly yours,
BLENHEIM SILK HOSIERY COMPANY

Charles Storch

SUPPOSE you were sitting across the desk from Chief Engineer Charles Storch of the Blenheim Silk Hosiery Company of Blackwood, New Jersey. Suppose you asked him:

"How long have you used RING-FREE?"

"Four years," he would tell you.

"Before you used RING-FREE, how often was it necessary to overhaul your diesels?", you might ask.

"Once every year."

"How often now—with RING-FREE?"

"Since RING-FREE keeps the motors so clean and free from carbon," he would answer, "the motors are now overhauled only once every two years."

"Any difference in oil consumption?"

"Oil consumption has dropped better than 10%," is his answer.

"Notice anything else?"

"Due to reduction of friction, our engines run cooler and with very little vibration."

"Is RING-FREE worth what it costs?"

"In my opinion, RING-FREE is the finest oil on the market and I find that the slight extra cost is more than compensated for by RING-FREE'S multi-economical performance."

Every single statement of Mr. Storch quoted above is taken from a letter by him dated March 5, 1942—ending with:

"You may use this letter as you see fit."

Whole-hearted testimonies of this kind pour into our offices from all parts of the country continually. What RING-FREE is doing for others, it can do for you. Write us!

MACMILLAN RING-FREE MOTOR OIL

MACMILLAN PETROLEUM CORPORATION

50 West 50th St., New York • 624 South Michigan Ave., Chicago

530 West 6th Street, Los Angeles

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Keep those boilers going!
● A year ago it was bad enough when a boiler had to be shut down for repairs to the setting. But today a delay that upsets your production schedule is a downright tragedy. It's not only costly to you, but serious to customers who depend upon you for badly needed supplies.
The installation of "Carbofrax" along the clinker line on side walls and in front and bridge walls is one sure way of providing for continuity of operation. Besides eliminating frequent and untimely outages, due to lining failures, the use of "Carbofrax" brick insures maximum steam production because clinker does not build out on them. With the full effective grate area thus maintained, combustion conditions are vastly improved and greater efficiency results.
"Carbofrax" brings you these benefits because of its extremely high refractoriness—outstanding resistance to spalling, cracking and clinker adhesion.
Regardless of the purpose for which you develop steam and whether it be in the steel mill, forge shop, process industries, etc., continuous boiler operation is especially important during these turbulent days. Why not call on our representative to explain in more detail how "Carbofrax" will help you attain uninterrupted service and at the same time lower your refractory and maintenance costs.
CARBORUNDUM
Refractory Division
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District Sales Branches: Chicago, Philadelphia, Detroit, Cleveland, Boston, Pittsburgh.
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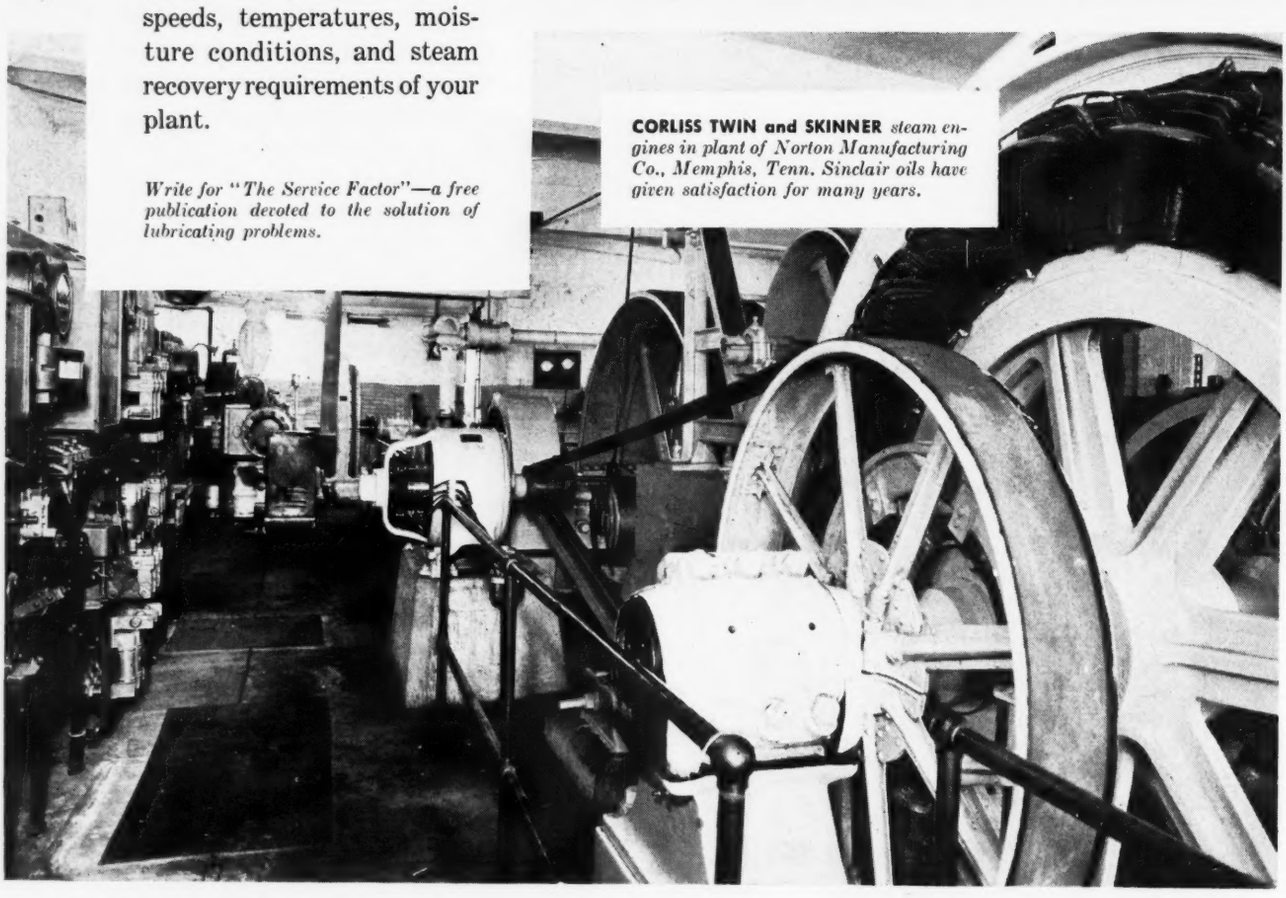
WAR DELIVERIES fall short if power output is not fully maintained. For lubrication that promotes sustained full power output by *STEAM ENGINES* use...

...SINCLAIR STEAM CYLINDER and VALVE OILS. They meet severe loads and any combination of speeds, temperatures, moisture conditions, and steam recovery requirements of your plant.

Write for "The Service Factor"—a free publication devoted to the solution of lubricating problems.



CORLISS TWIN and SKINNER *steam engines in plant of Norton Manufacturing Co., Memphis, Tenn. Sinclair oils have given satisfaction for many years.*

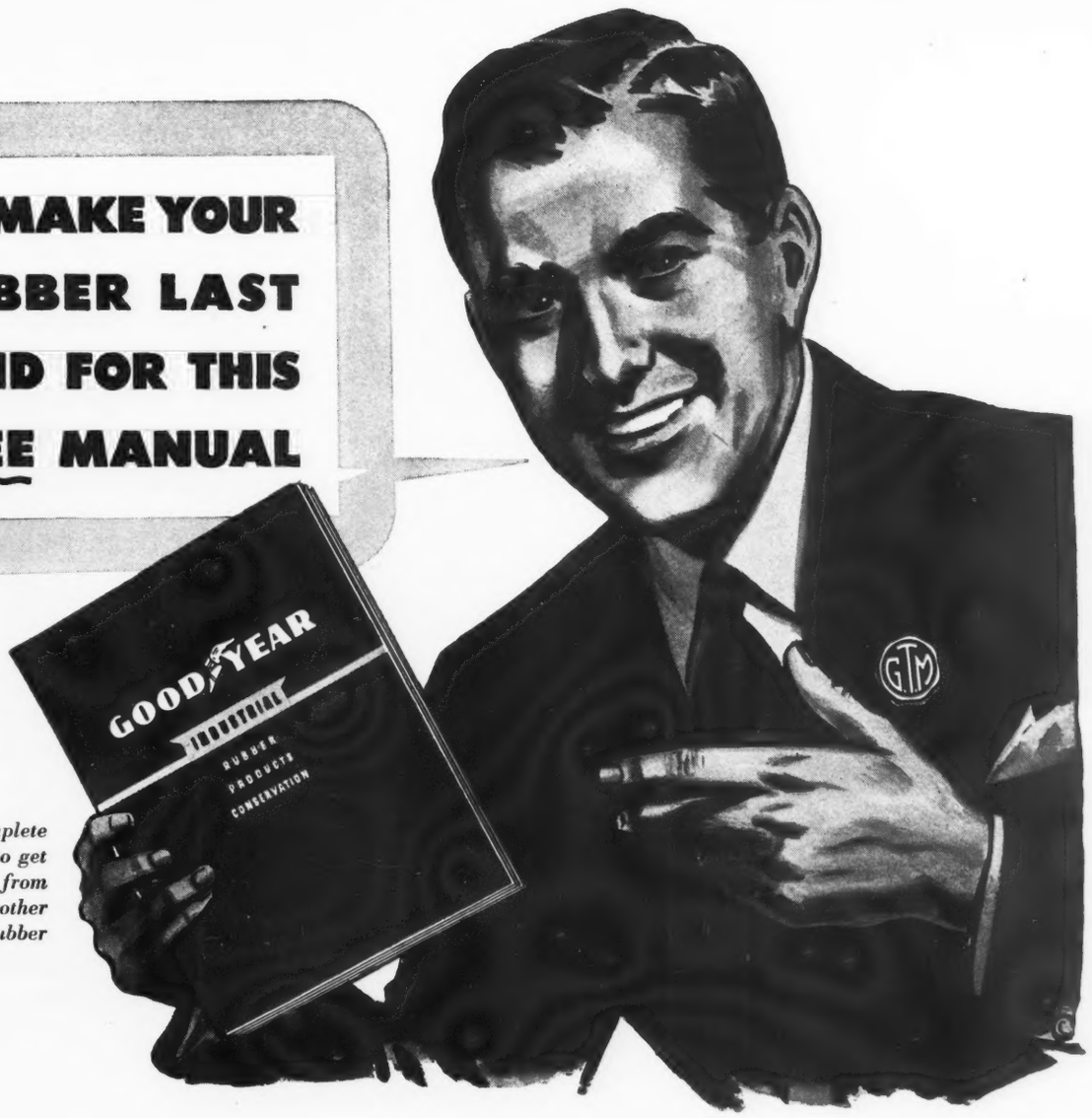
SINCLAIR INDUSTRIAL OILS

FOR FULL INFORMATION OR LUBRICATION COUNSEL WRITE NEAREST SINCLAIR OFFICE

SINCLAIR REFINING COMPANY (Inc.)

2540 West Cermak Road, Chicago • 10 West 51st Street, New York City • Rialto Bldg., Kansas City • 573 West Peachtree Street, Atlanta • Fair Building, Ft. Worth

TO MAKE YOUR RUBBER LAST SEND FOR THIS FREE MANUAL



—contains complete data on how to get longer wear from belts, hose and other mechanical rubber goods.

EVERY user of rubber will want this new Goodyear Industrial Rubber Products Conservation manual. It tells you how to prolong the life of your present rubber installations—how to prevent premature failures that cause the needless waste of millions of pounds of rubber every year.

It's authoritative because it is written by the G.T.M. —Goodyear Technical Man—industry's consultant on all major rubber problems. It's complete, filled with practical suggestions and diagrams covering installation, inspection, maintenance, correction of abuses, and instructions for proper repair. It's essential, even if you hold a priority, *because there's no telling what further restrictions may be put on rubber!*

Remember, improper application and maintenance can reduce the life of rubber products by as much as 50%. This manual will enable you to recognize and correct all such cases now—help you save rubber and save money. To get your free copy mail the coupon below—today.

THE GREATEST NAME IN RUBBER

GOODYEAR
MECHANICAL
GOODS

DO IT NOW

GOODYEAR, AKRON, OHIO
Dept. B-12

Kindly send me free copy of "Goodyear Industrial Rubber Products Conservation."

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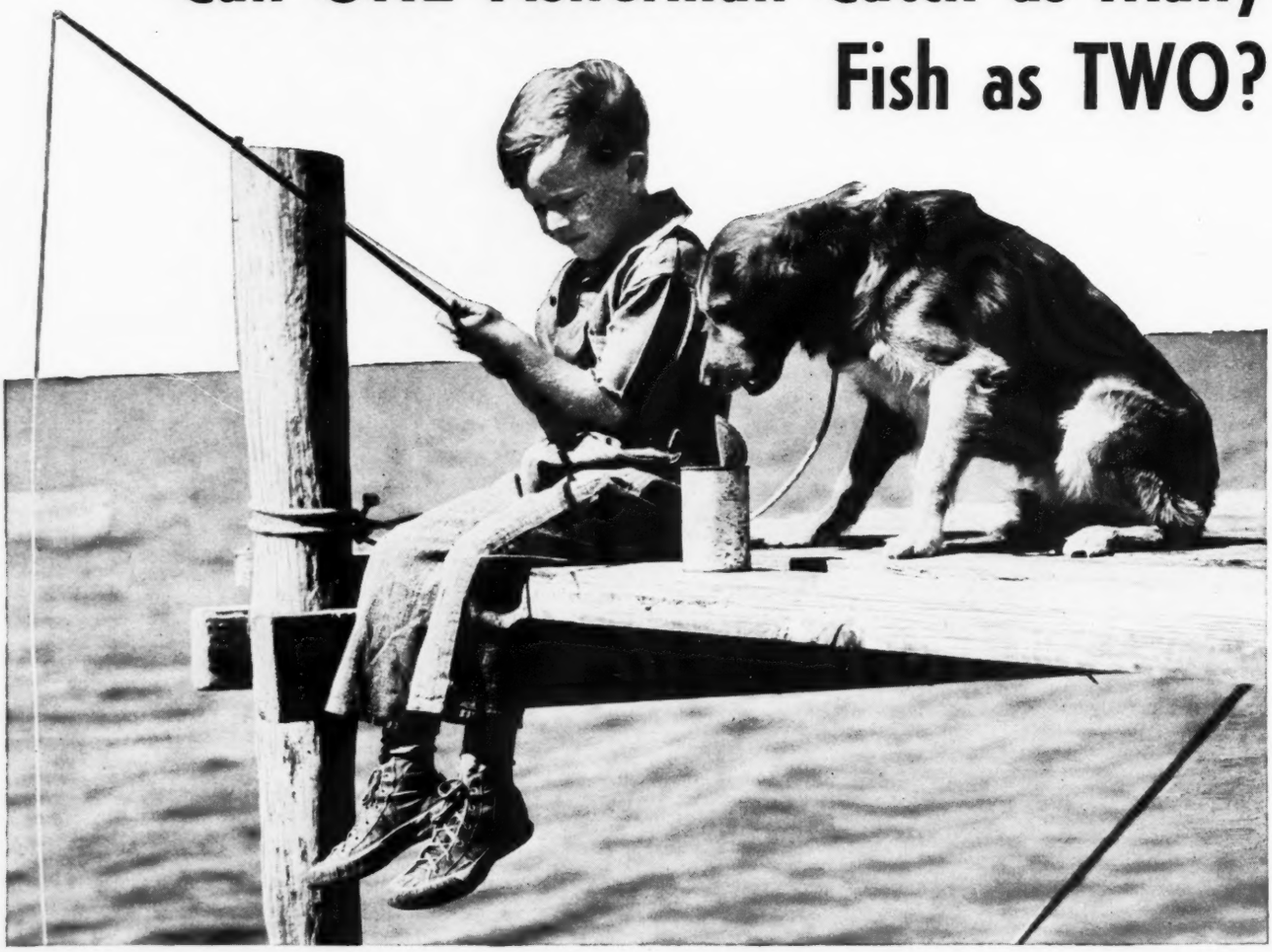
Can ONE Fisherman Catch as Many Fish as TWO?



It's the same with catching dust. You get *two* tries instead of *one* with a Thermix Recirculator Dust Collector. If any dust escapes when it first passes through the cyclone of a Thermix, it has a *second* chance to be caught as it is recirculated through the entire system the *second* time. Therefore, if 72% dust collection efficiency can be obtained without recirculation, then the use of recirculation will increase collection to 87.8%.

The Thermix Recirculator overcomes its own draft loss—a vital and exclusive feature. It is frequently used to actually boost a deficient draft.

It can and generally is used also as the induced-draft fan and dust collector combined and occupies not much more space than an ordinary I.D. fan.

The fan may be equipped with patented Thermix Blades, which has replaceable wearing surfaces.

Thermix Dust Collectors are also made in two other types, the space-saving and efficient Thermix Tubular Collector, and the Thermix Controlled Multicyclone, which has the highest collection efficiency at variable loads. Hundreds are in use.

Write for catalog No. 105.

PRAT-DANIEL CORPORATION

Manufacturers of Dust Collectors and Induced Draft Thermix Stacks

88 So. Water St., Port Chester, N. Y.

Representatives in Principal Cities

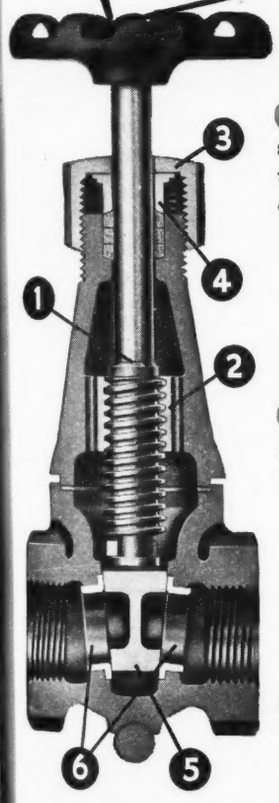
Thermix Recirculator DUST COLLECTOR

SAVE BRONZE by SUBSTITUTION

WHERE PRACTICAL, SPECIFY IRON BODY BRONZE MOUNTED SADDLE GATE VALVES ...IN PLACE OF BRONZE VALVES

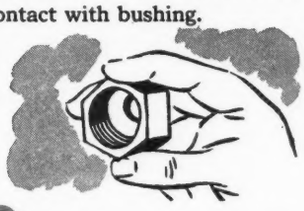
Users of valves can help themselves as well as the war effort by substitution. The Walworth Figure 709 Bronze Mounted Iron Body Valve, for example, is made largely of iron. The seats and discs are of bronze, affording bronze-to-bronze contact. A bronze bushing cast in the bonnet provides bronze-to-bronze contact for the stem threads. Stuffing nut and gland are also of bronze, but the rest of the valve parts are iron. This Walworth Saddle Gate Valve can be used for many services where bronze valves have heretofore been specified. This valve is easy to take apart, clean, and put together.

Let's all cooperate by intelligent substitution, using less of the scarce metals wherever possible and prolonging the life of all valves by proper servicing at regular intervals.



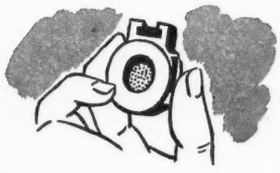
1 Stems are of high tensile strength wrought bronze. Stem threads have bronze-to-bronze contact with bushing.

2 Bushing is bronze and is made with drainage holes. Bushing is cast in the iron bonnet.



3 Bronze stuffing nut is rugged and of hexagonal construction for easy tightening.

4 Gland is wrought brass and can be lifted easily by means of a screw driver inserted under the shoulder.



5 Solid wedge-type disc is bronze, of slip-on, lock-on construction.

6 Bronze seat rings afford bronze-to-bronze contact with disc.

BUT THE REST OF THE VALVE IS IRON!

WALWORTH 1842 1942 VALVES AND FITTINGS 100TH. ANNIVERSARY

A century ago Walworth first manufactured valves and fittings. Walworth has been manufacturing valves and fittings continuously ever since.

WALWORTH

VALVES FITTINGS and TOOLS
Backed by 100 Years' Service

WALWORTH COMPANY
60 EAST 42nd STREET, NEW YORK

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

Installation of Super Refractory Brick in Various Types of Boiler Furnaces

The drawings and explanation below are based upon recent installations of Crystolon (Silicon Carbide) brick in boiler furnaces. Results have been completely satisfactory when the directions given here were followed.

Crystolon brick are proving satisfactory for today's war-time need of uninterrupted peak operation. Produced at high temperatures these brick are particularly resistant to extreme heat. Their hardness makes them resistant to the abrasive action of ash and the motion of the fire bed.

The surfaces of Crystolon brick are sufficiently dense to prevent molten ash from taking hold by penetration and this same density enables them to resist the erosive action of slag.

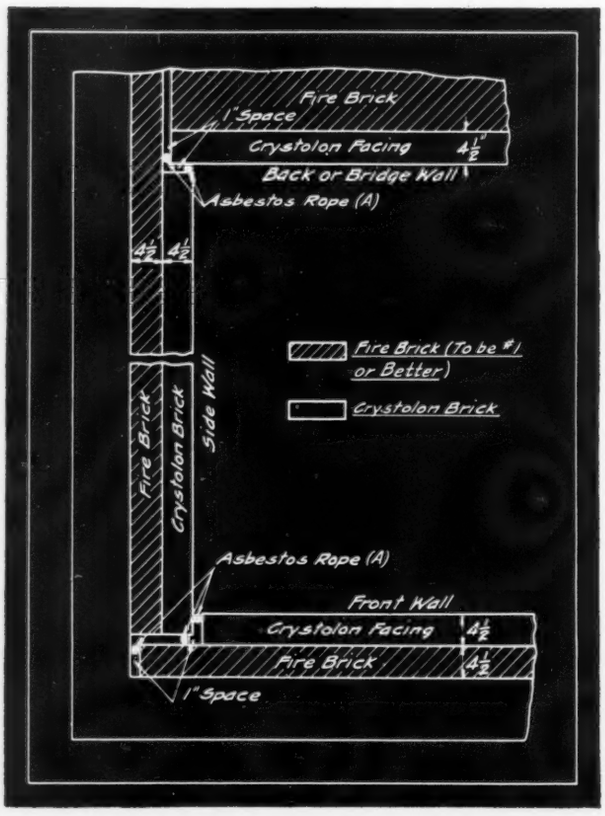


FIG. 1 *Typical Setting Showing Expansion Joints (A)*

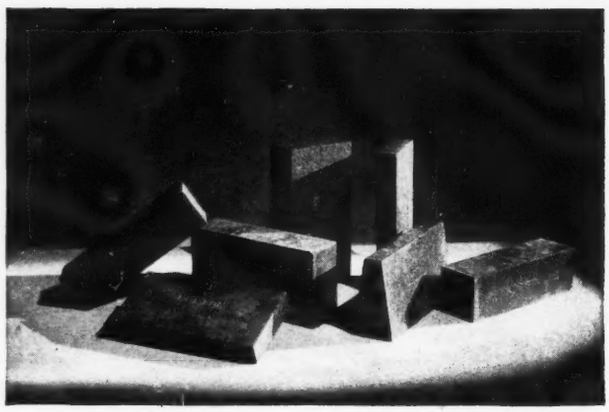


FIG. 2 *Crystolon Brick for Boiler Furnaces*

Other types of refractory brick often necessitate shutdowns or down-time to remove the clinker. While the clinker may sometimes adhere to Crystolon brick to a limited extent, these brick are sufficiently rugged to withstand the rather rough barring action that is commonly used to knock off the clinker.

Super refractory brick although costlier than ordinary fire brick actually give more economical service through reduced maintenance time and longer life.

It is advisable to use the same construction in the bridge wall as is shown (Fig. 1) for the side wall when Crystolon brick are used.

In cases where it may not be convenient to put in expansion joints as shown (see A, Fig. 1), expan-

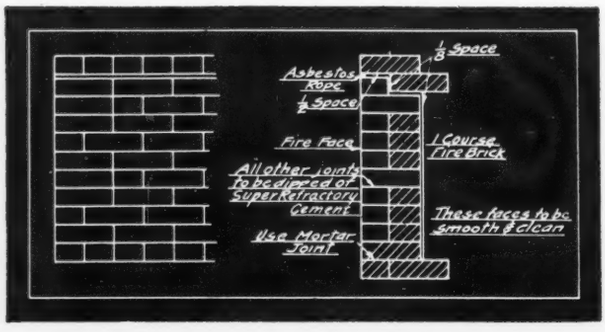

⅛ Space
Asbestos Rope
½ Space
Fire Face
1 Course Fire Brick
All other joints to be dipped or Super Refractory Cement
These faces to be smooth & clean
Use Mortar Joint

FIG. 3 *Construction Using from 9 Courses up to 4' of Crystolon Brick*

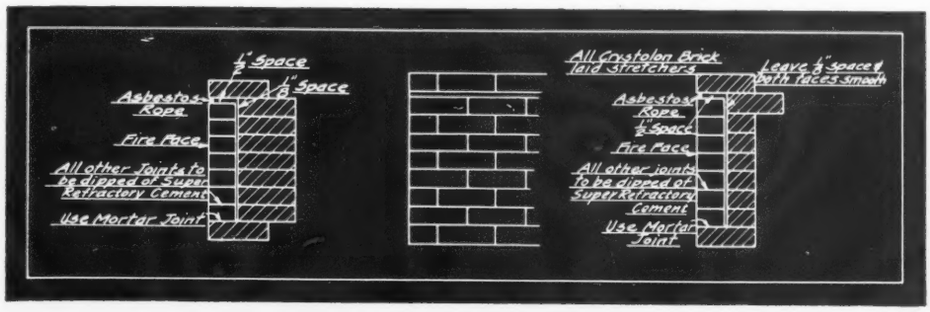

½" Space
⅛" Space
Asbestos Rope
Fire Face
All other Joints to be dipped of Super Refractory Cement
Use Mortar Joint
All Crystolon Brick laid Stretchers
Leave ½" Space & both faces smooth
Asbestos Rope
½" Space
Fire Face
All other joints To be dipped of Super Refractory Cement
Use Mortar Joint

FIG. 4 *New Construction (left) and Repairing Old Construction (right) Where 7 Courses or Less Are Used*

sion can be taken care of by leaving $\frac{1}{16}$" to $\frac{1}{8}$" open joint between each brick in the stretcher courses or every second brick in a header course. In any case, expansion allowances must be made. A good rule to use is approximately $\frac{1}{8}$" expansion to 15" of Crystolon brick in the wall.

For best results, not less than five courses of Crystolon brick should be used in any boiler furnace except in cases where exceptionally thin fire beds are carried and peculiar conditions of operation might justify the use of fewer courses.

In general, five to nine courses are used depending on the type of stoker, size of furnace, thickness of fuel bed carried and rating at which boiler is to be operated. If too few courses are used, there is danger of a slag curtain building down from the fire brick above and interfering with the efficiency of the Crystolon brick.

Always use a super refractory cement* for laying up the Crystolon brick. A dipped joint is best in laying Crystolon brick, unless otherwise specified. The brick should be hammered down tightly to make as nearly a face-to-face joint as possible. *Do not use ordinary fire clay or fire brick cements nor any of the groups known as air-setting or air-hardening cements in contact with the Crystolon brick.*

*Send for Norton Refractory catalogs: Cement No. 863-Crystolon Brick No. 862.

In the center retort, side-dump type of stoker the Crystolon brick should be started 3" below the nose of the dump plate.

In the multiple retort type of underfeed stoker the Crystolon brick should start at the grate line and follow the slope of the stoker, using a few more courses of Crystolon brick in the side wall toward the rear of the stoker. It is well to use standard jamb or bull nose and arch brick to build around the rear inspection door.

In the chain grate type of stoker the Crystolon brick should be laid directly on the side wall bed plate or in any case should start slightly below the top of the chain grate. In the case of one type of Cox stoker now in use a special Crystolon brick is employed with a ½" cut-out which fits directly over the side wall plate.

In hand-fired boiler furnaces it is common practice to start the Crystolon brick an inch or two above the top of the grate.

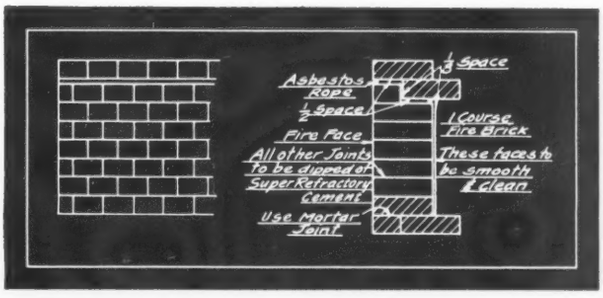
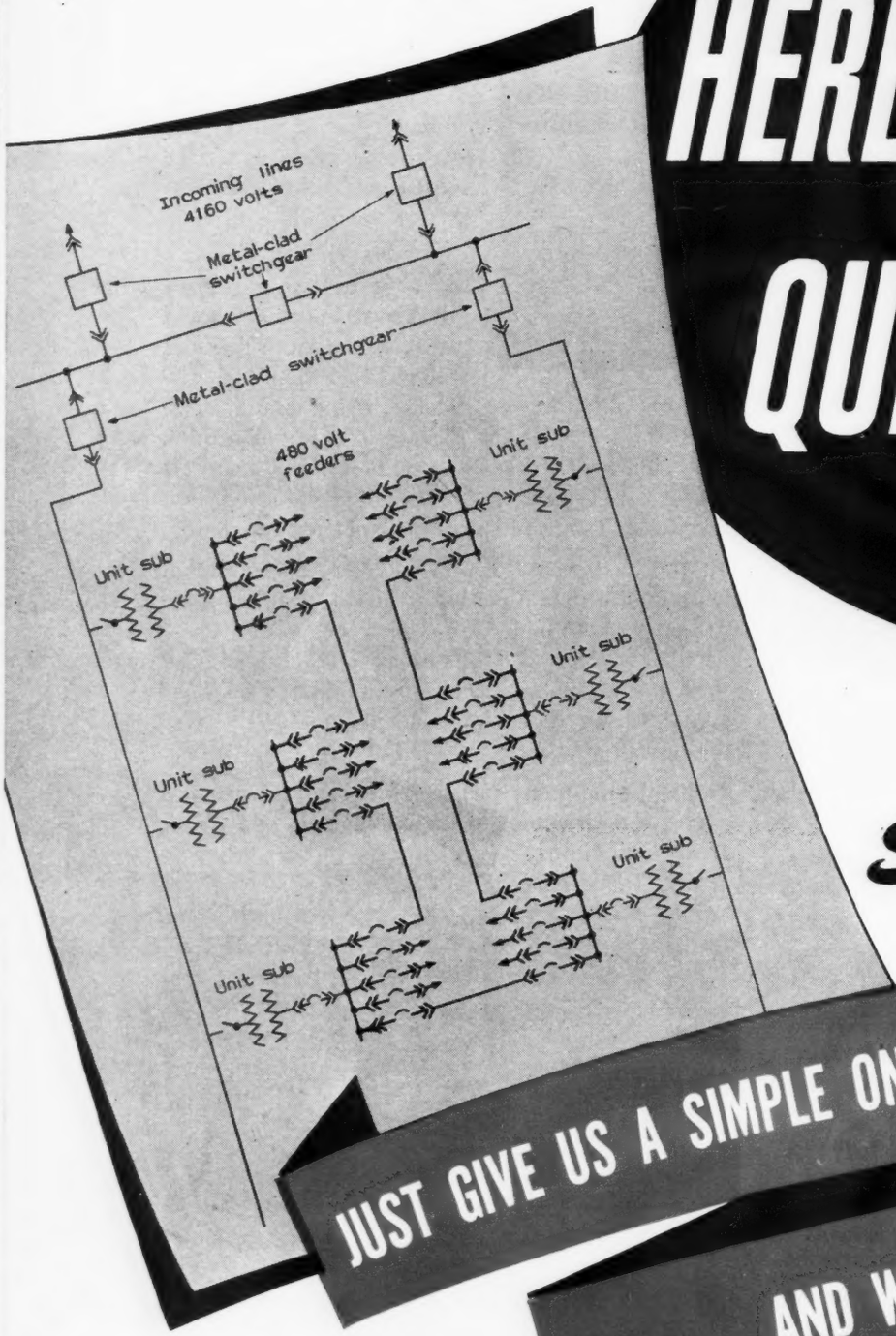

⅛ Space
Asbestos Rope
½ Space
Fire Face
All other Joints To be dipped of Super Refractory Cement
Use Mortar Joint
1 Course Fire Brick
These faces to be smooth & clean

FIG. 5 *Construction Using 9" Crystolon Wall All Headers up to 4' in Height*

NORTON ELECTRIC FURNACE FUSED REFRACTORIES
ENGINEERED FOR EACH JOB BY NORTON COMPANY, WORCESTER, MASS.

HERE'S A NEW QUICK WAY



TO GET SWITCHGEAR

JUST GIVE US A SIMPLE ONE-LINE DIAGRAM

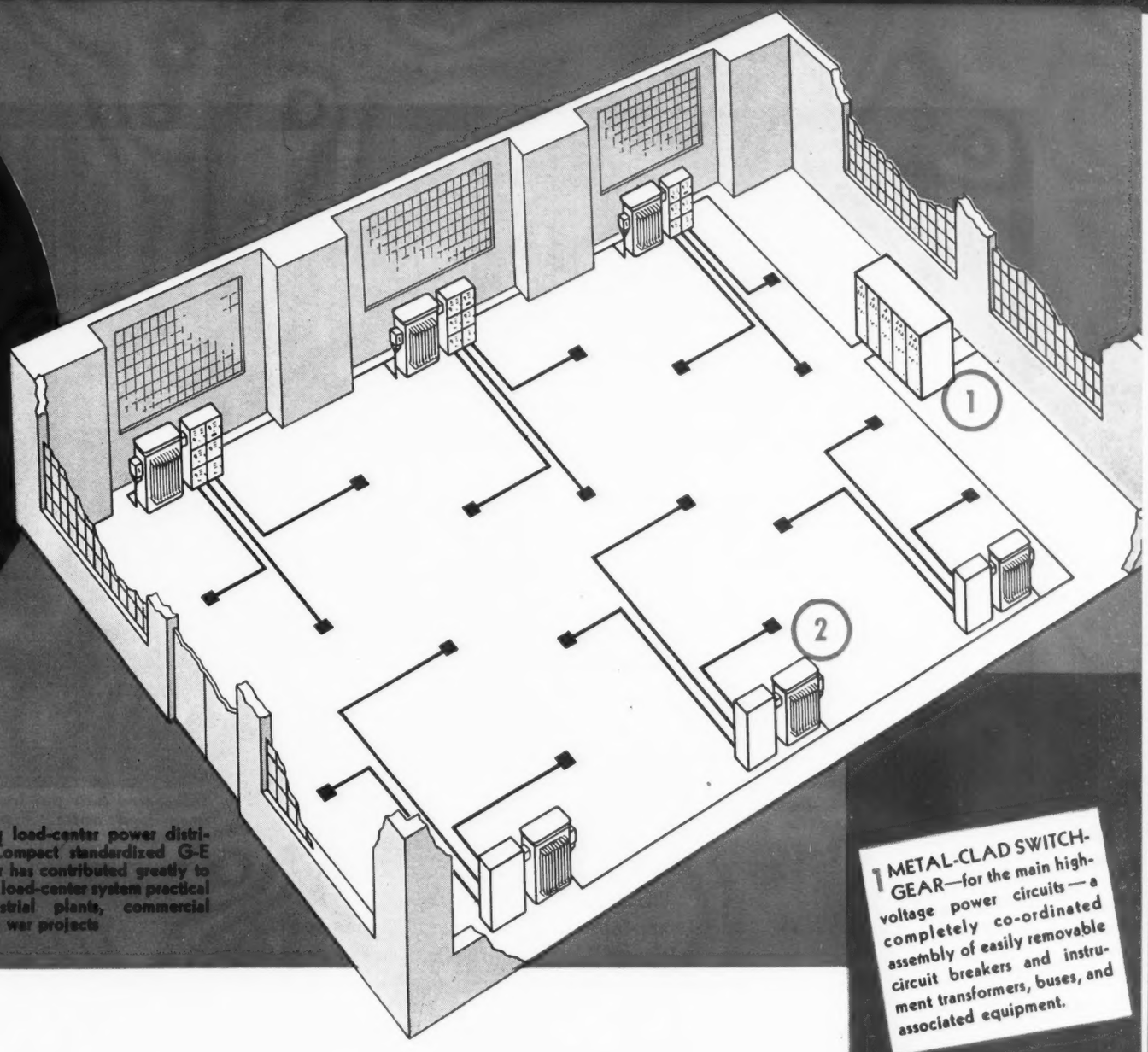
. . . . . AND WE'LL GO TO WORK ON

STANDARD SWITCHGEAR equipments mean *more* and *better* switchgear for scores of plant engineers charged with equipping new and enlarged plants for wartime production.

More — because our own war-geared factories are tooled to make standard switchgear in ever-increasing volume. This means you'll get standard switchgear sooner.

Better — because we've worked for years to standardize the best equipments. We established a "one best" standard in every line—designed it for superior service over a wide range of applications. In recent years, industry ordered thousands of these "packaged" units to gain added safety, operating dependability and economy. Now the speedy production of switchgear, as well as quick installation, is so vital that standard switchgear is an ***absolute necessity.*** And we're ready, with standard equipments already developed and proved.

General Electric and its employees are proud of the Navy award of Excellence made to its Erie Works for the manufacture of naval ordnance.



Illustrating load-center power distribution. Compact standardized G-E switchgear has contributed greatly to make the load-center system practical for industrial plants, commercial buildings, war projects

1 METAL-CLAD SWITCHGEAR—for the main high-voltage power circuits—a completely co-ordinated assembly of easily removable circuit breakers and instrument transformers, buses, and associated equipment.

2 LOAD-CENTER UNIT SUBSTATIONS—for distribution, control, and protection of low-voltage power up-to 600 volts—a completely co-ordinated assembly of drawout-air-breaker switchgear equipments, transformers, and high-voltage protective devices.

EVERYTHING IN STATION SWITCHGEAR, TOO—Complete switchgear for the power station is described in our new bulletin, GEA-3742 — everything from large FH cubicles right down to the metal-enclosed bus runs.

Standard EQUIPMENTS

Get Any or All of Your Plant Switchgear Equipments This Easy Better Way

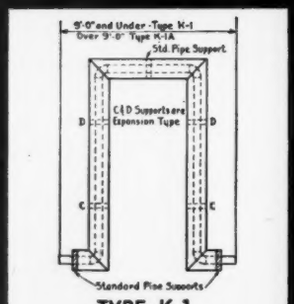
NOW you can save precious days and weeks formerly spent over the drawing board and in drawn-out correspondence. Now you need only give us a simple one-line diagram showing the switchgear functions to be performed and the ratings.

You'll get our standard switchgear—the best, and the safest, we know how to build.

You can get everything you need in plant switchgear this quick, simple way. Every one of our standard equipments is designed for the broadest possible application. Our line of standard equipments is complete. Ask your nearest G-E office for additional information, or write the General Electric Company, Schenectady, N. Y.

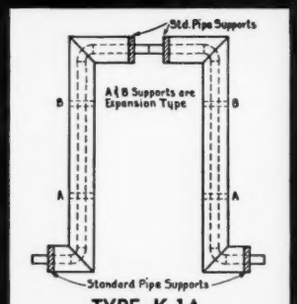
GENERAL ELECTRIC

854-16-7800



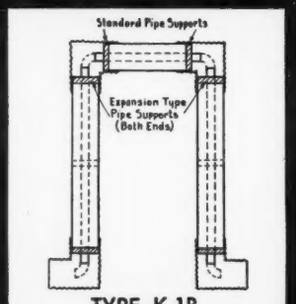
TYPE K-1

1-piece completely factory assembled U-Bend.



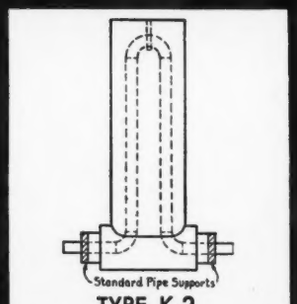
TYPE K-1A

2-piece U-Bend (2-Z-Bends) for connection in the field.



TYPE K-1B

3-piece U-Bend for field assembly (split conduit elbows furnished).



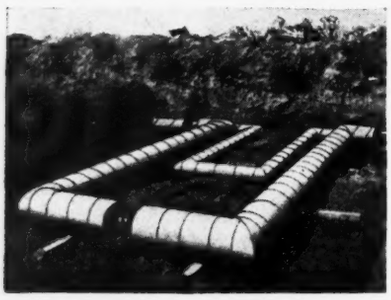
TYPE K-2

Hair Pin Type Expansion Loop completely pre-fabricated.

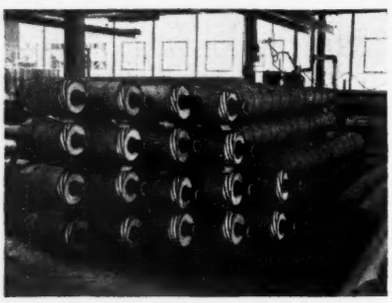
★ PRE-FABRICATED EXPANSION LOOPS ★

FOR YOUR STEAM OR HOT WATER LINES

Slip elbows to form U-Bend expansion fittings on the job. Type K-1B



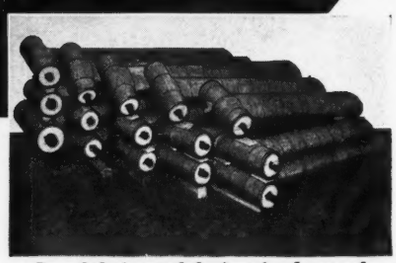
Nested expansion U-Bends for main and return lines. Type K-1A and K-1



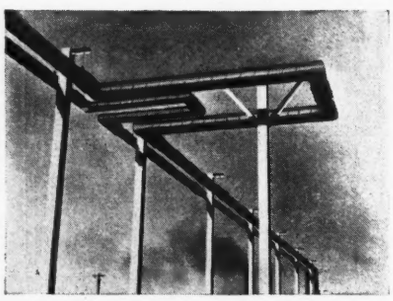
Halves of large U-Bends fabricated for field assembly. Type K-1A

Speed is imperative on steam and hot water lines vital to the war program. Don't stay on the defensive, waiting for material to complete your war construction contracts. GET ON THE OFFENSIVE by using Ric-wiL pre-fabricated expansion U-Bends or Loops! They are furnished, in choice of types shown, for any kind of service—underground or overhead, inside or outside lines. Correctly engineered per your plans and specifications, including insulation. Precision-made under controlled factory conditions. Conduit tested for air-tightness and pipe hydrostatically pressure-tested to code requirements. Shipped to the job *ready to install.* Built for strength and safety. No flanges to tighten—no gland packing or gaskets—no maintenance—no danger from leakage. Write for new Data Charts on expansion loop calculation for various conditions.

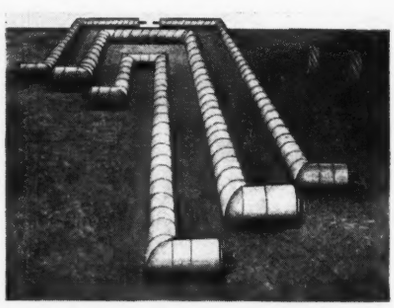
If you will furnish sketch showing conditions, pipe sizes and amount of expansion needed (or temperature of line and distance between anchors)—we will give you detail dimensions and prices.



Pre-fabricated hair pin loops for flange welded units. Type K-2



Overhead steam and return lines with expansion bends. Type K-1A



Z-Bends (K-1A) and U-Bends (K-1) with offset ready to weld into line.

RIC-WIL

CONDUIT SYSTEMS FOR UNDERGROUND STEAM

THE RIC-WIL COMPANY • CLEVELAND, OHIO

AGENTS IN PRINCIPAL CITIES

DON'T TAKE CHANCES ON RUST

YOU NEVER KNOW when rust may stop your turbines. And right now is no time to take a chance. Lubricate with the new tested and proved Shell Turbo Oil, the turbine oil that meets all *three* requirements of modern turbine lubrication . . .

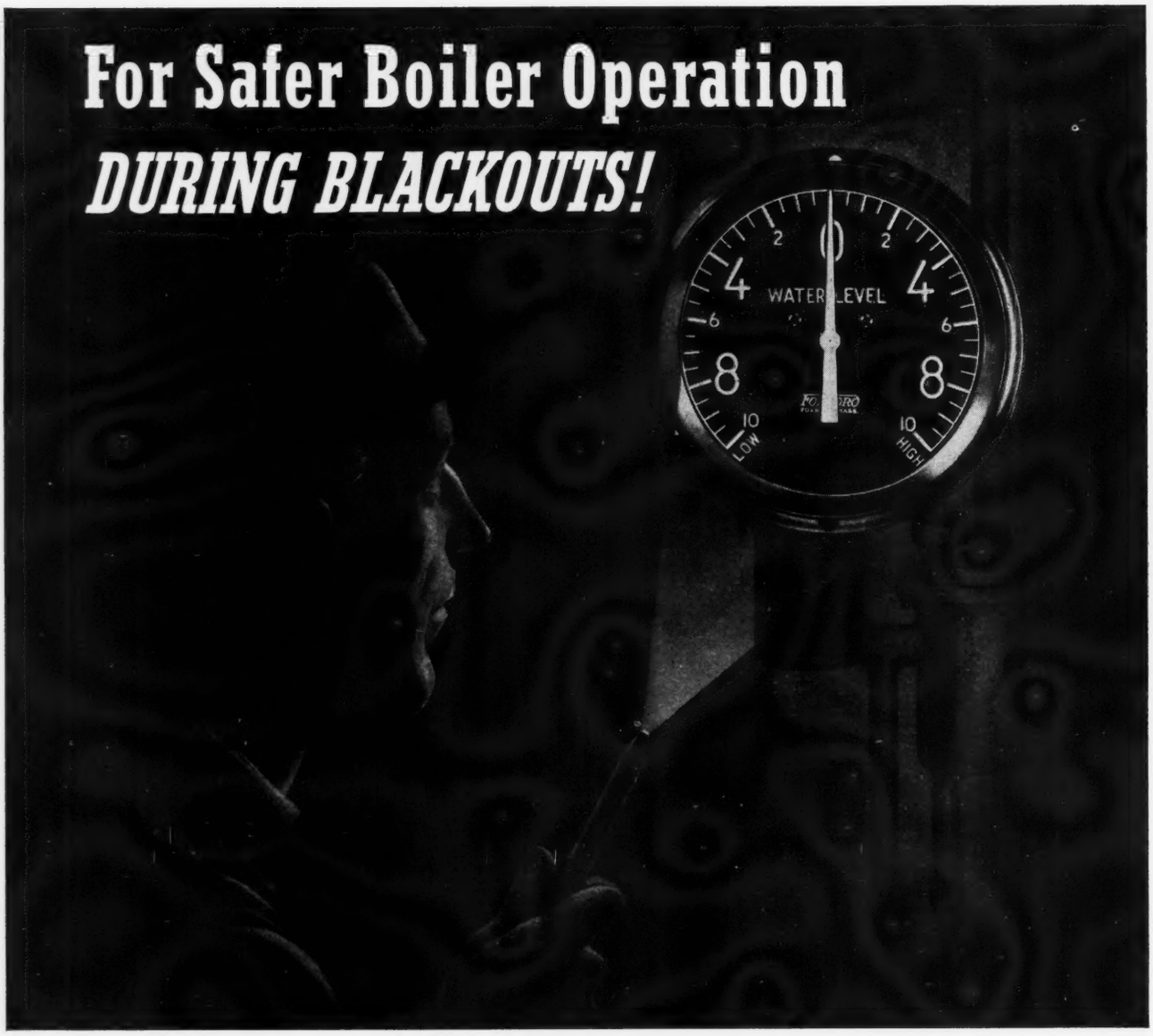
RUST PREVENTION
SUPERIOR OXIDATION STABILITY
MINIMUM FOAMING TENDENCY

There's no reason for you to accept less. Call in Shell now!

SHELL

Guard YOUR turbines with New RUST-PREVENTIVE SHELL TURBO OIL

For Safer Boiler Operation *DURING BLACKOUTS!*



Get your water level readings down where you can read them!

A boiler room has too many horse-power roaming around, to take any chance that they may run wild under cover of an air-raid blackout. For safety, you need a quick, positive way to check up boiler water level at a glance, instead of straining to see a gauge glass 5 to 10 feet overhead.

Bring 'Em Down to Eye-Level

The easy addition of a Foxboro Boiler Water Level Indicator puts these important readings right before your eyes. Without interference with your regular gauge glass, this instrument can be installed in any convenient spot, at "head-height" from the floor. Its clean-cut dial face shows up sharply without any other light than an Official Blackout Flashlight!

Permanent Convenience

Blackout or no blackout, Foxboro Boiler Water Indicators insure surer, safer boiler operation because they practically can't be overlooked or mis-read. Simply designed, ruggedly constructed, they're good for years of service without maintenance. Made for pressures up to 800 lbs. – other models to 5000 lbs.

Get Ready NOW

Don't let blackouts catch you unprepared. Write today for Bulletin B-319, "Foxboro Boiler Water Level Indicators". **The Foxboro Company, 68 Neponset Ave., Foxboro, Mass., U. S. A.** Branches in principal cities of United States and Canada.

FOXBORO
Reg. U. S. Pat. Off.

BOILER WATER LEVEL INDICATORS

MANHATTAN IS ENLISTED UNDER THE EAGLE'S BANNER

This war will be won by *Offense*, not by Defense. The transition is under way through the mobilization of every strategic material, of every man, and every machine in production for war—huge production dedicated to the single purpose of Victory.

In the strategic materials, rubber shoulders a great responsibility—a responsibility which CONDOR and MANHATTAN have long been qualified to assume.

But the responsibilities of quality, capacity and performance have been tremendously complicated by a scarcity not yet fully emphasized by restrictions on tires and other consumer items made of rubber.

Industry turns on rubber; it pumps, drives, controls and conveys with the aid of rubber in the form of hose, transmission belting, diaphragms, conveyor belts, and thousands of others. Planes, tanks, trucks, ships, submarines, all require rubber—rubber in the very forms and capacities which MANHATTAN has developed through the years the better to serve both industry and our armed forces.

It is no longer a matter of diverting *part* of the supply to the requirements of war production and prosecution, but of allocating *all* the rubber to the single objective of Victory.

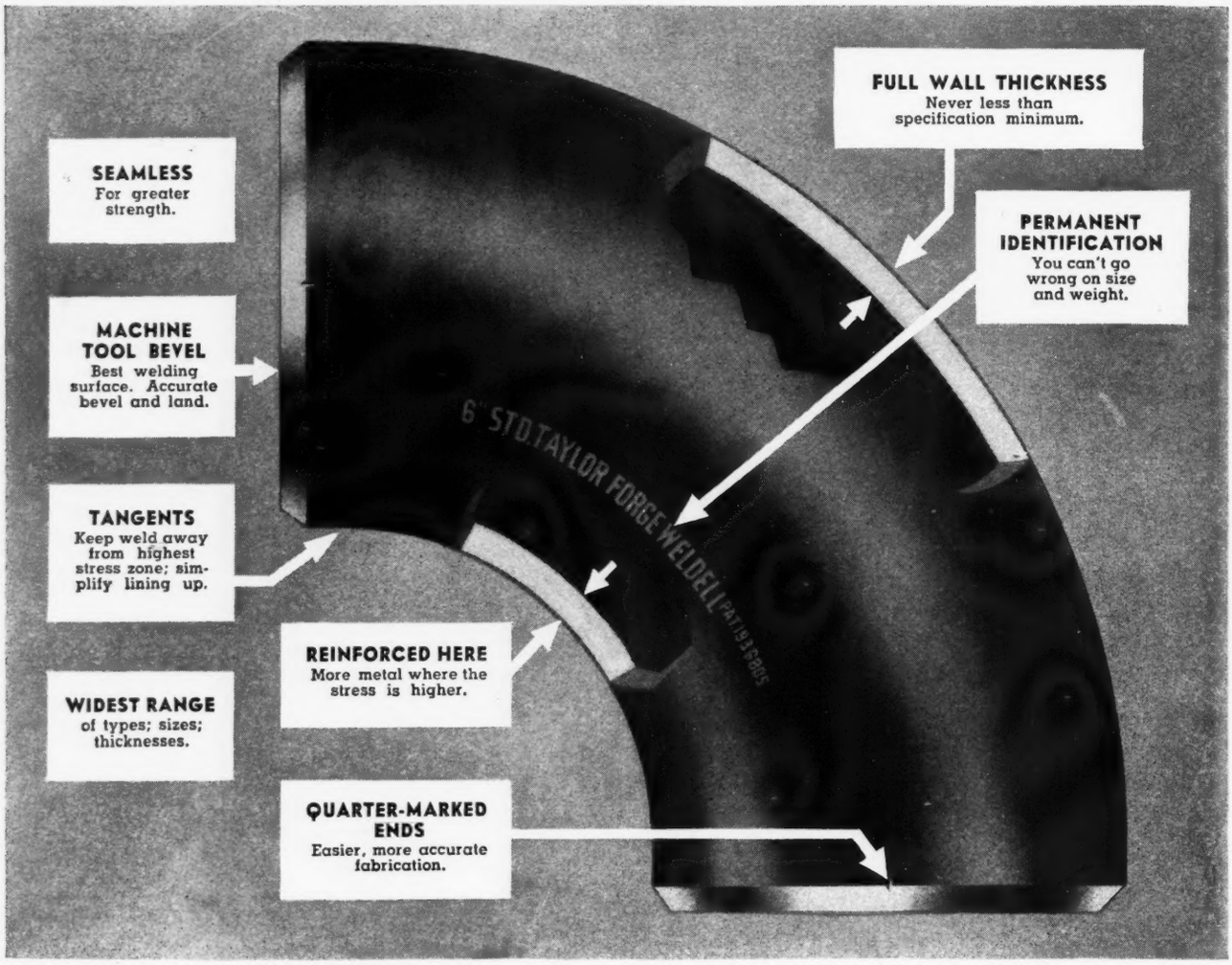
"Priorities" sits in the swivel chair and determines how much, how soon, to whom and where MANHATTAN and CONDOR Rubber Products shall go. "How much" means not only the quantity which may be obtained, but already the amount and kind of rubber (natural, reclaimed and synthetic) which may be used in manufacturing a given product.

The edicts of necessity are being accepted everywhere with understanding because patriotism expresses itself in cooperation toward the common cause of Victory.

To say "greater care means longer wear" is not enough. MANHATTAN sales engineers are prepared to go over your plant to show how to get the maximum wear and service out of your MANHATTAN Rubber Products — thereby fewer interruptions to the production that will speed Victory.

THE MANHATTAN RUBBER MANUFACTURING DIVISION
of RAYBESTOS-MANHATTAN, INC.
EXECUTIVE OFFICES and FACTORIES . . . PASSAIC, NEW JERSEY

KEEP AHEAD WITH MANHATTAN


SEAMLESS
For greater strength.
MACHINE TOOL BEVEL
Best welding surface. Accurate bevel and land.
TANGENTS
Keep weld away from highest stress zone; simplify lining up.
WIDEST RANGE
of types; sizes; thicknesses.
FULL WALL THICKNESS
Never less than specification minimum.
PERMANENT IDENTIFICATION
You can't go wrong on size and weight.
REINFORCED HERE
More metal where the stress is higher.
QUARTER-MARKED ENDS
Easier, more accurate fabrication.
6" STD. TAYLOR FORGE WELDELL

These features of WeldELLS

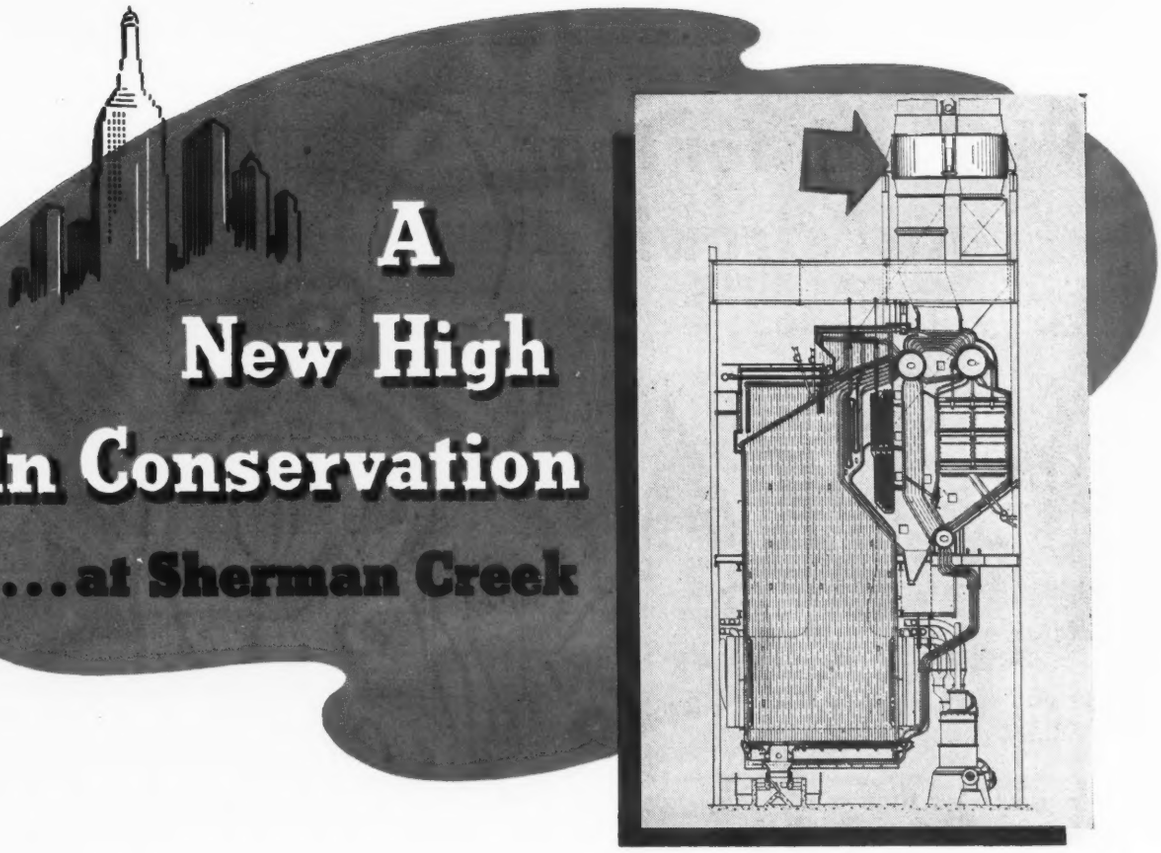
mean more than ever now

WHEN purchases are restricted to essential uses — uses, in other words, that contribute to winning a war that *must* be won — then, surely, is the time of times to *know what you're getting.*

So once more we show you here, in boiled down, quick-reading form, the facts about WeldELLS — the eight features of WeldELLS that contributes *something* to every pipe welding job — in ease of installation, in economy, in speed, in safety, in soundness, in the lasting satisfaction that goes with using the *best.*

If your requirement is vital enough to rate a preference, it is vital enough to rate the finest — particularly when the finest *costs no more.* Busy though we are, we want to sell you welding fittings at their best — and so do our distributors.

TAYLOR FORGE & PIPE WORKS, *General Offices & Works:* Chicago, P.O. Box 485
New York Office: 50 Church Street • *Philadelphia Office:* Broad Street Station Building



A New High In Conservation ...at Sherman Creek

This great new steam generating unit will help the Consolidated Edison Company of New York to meet the peak power demands of any emergency. It furnishes steam for a single turbo-generator at a pressure of 1,625 lb. per sq. in., 955 deg. F. total temperature. Rated at 1,000,000 lb. steam per hour, it is "topped" by the two largest Ljungstrom Air Preheaters yet built. At capacity operation, gases will enter the preheaters at 660 deg. F., leave at 294 deg. F., heating combustion air to 580 degrees.

• • • • •

The bigger the job, the greater the opportunity for *conservation* . . . that's the lesson to be learned from Sherman Creek. Here, the Ljungstrom Air Preheaters aid conservation in four ways:

1. Fuel is saved . . . Higher heat recovery and improved combustion conditions are achieved with an adequate volume of preheated air.

2. Steel is saved . . . Ljungstrom Air Preheaters average *one-half* to *one-third* the weight of other types for the same degree of heat recovery. What's more, the regenerative heating surface used in the Ljungstrom is not of a type on which serious delivery "bottlenecks" exist.

3. Space is saved . . . Far more compact in itself than other units of comparable heat recovery, the Ljungstrom usually results in an appreciable saving of duct work space.

4. Structural materials and labor are saved . . . The lighter weight of the Ljungstrom means a saving in the supporting structural steel work and other foundation requirements. More compact duct-work saves labor and materials. Installation time is lowered.

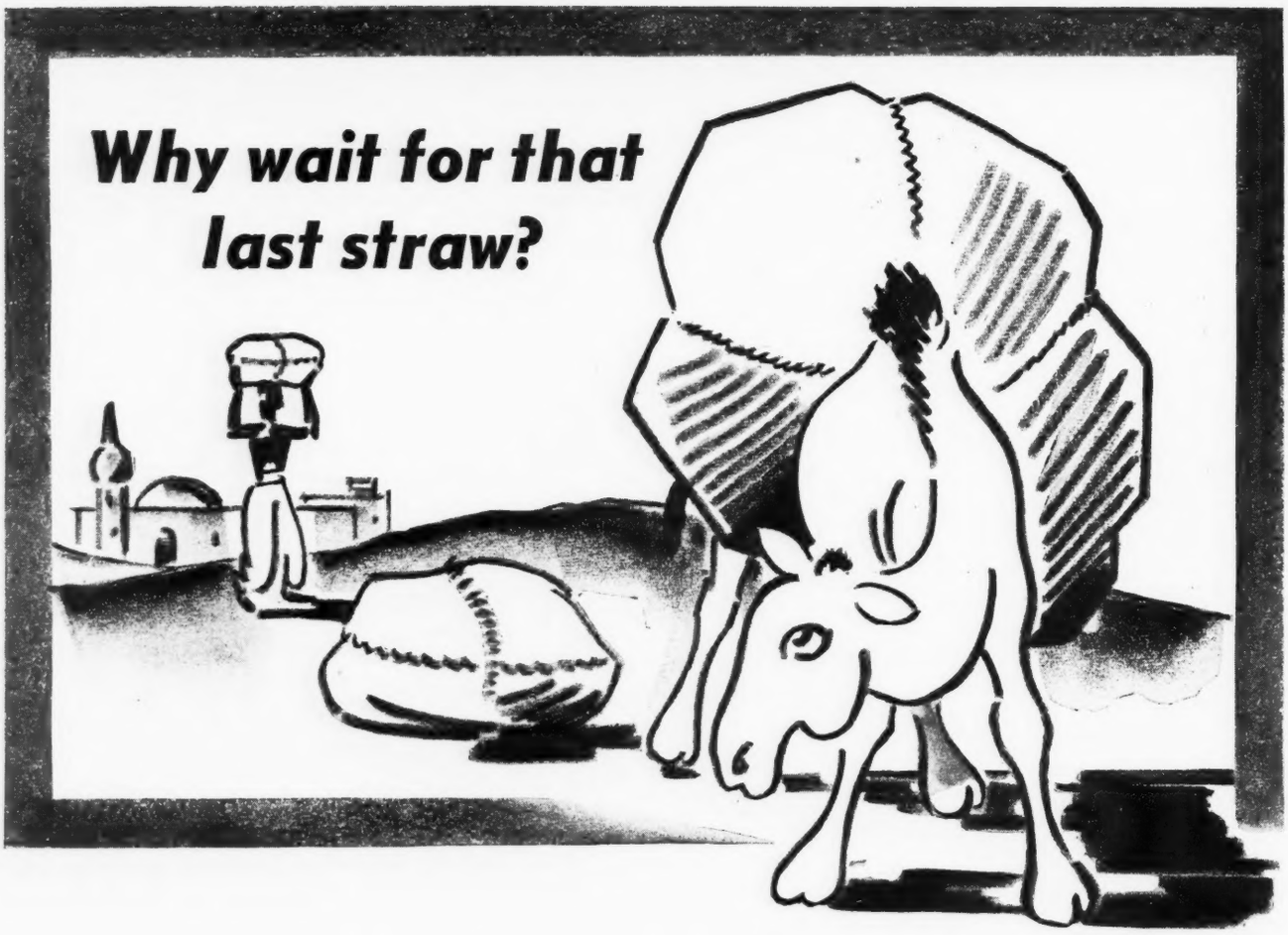
All the major builders of high-efficiency power plants are combining conservation with long-term operating efficiency by including Ljungstrom Air Preheaters on current jobs. Write for a factual analysis of the savings.

THE

AIR PREHEATER

CORPORATION

Executive Offices: 60 East 42nd Street, New York, N. Y. • Plant: Wellsville, New York



INCREASE your production — then double it — and redouble it. That's the cry these days. And still they tell us we "ain't seen nothin' yet." Manufacturing facilities that were adequate yesterday are taxed to the limit today. And it's none too soon to be anticipating the demands of tomorrow.

This is particularly true of water conditioning equipment, and right now is the time to take stock of the situation — to make a survey of demand and capacity from the standpoint of quality as well as quantity. Maybe there's still a safe margin — but you'll be wise to make certain. And if you're confronted with a problem, play doubly safe and consult Graver at once.

For more than 30 years Graver has specialized in the design and manufacture of water conditioning equipment of all types. Graver engineers have tackled the most difficult water conditioning problems — and solved them. They'll gladly make an analysis of water samples and submit unbiased recommendations without cost or obligation.

Write Graver — today.

WATER SOFTENERS
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FILTRATION SYSTEMS
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SEWAGE EQUIPMENT
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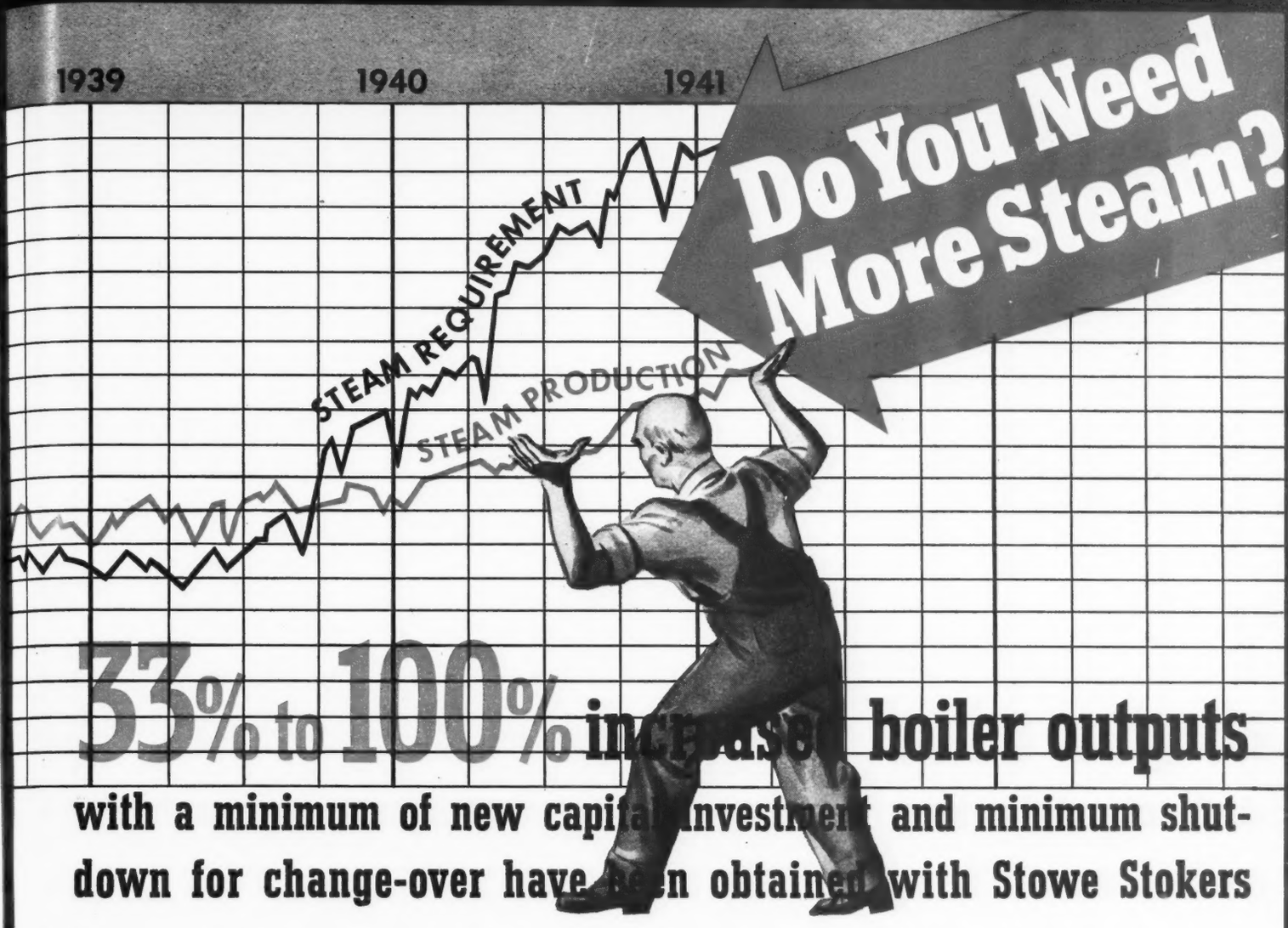
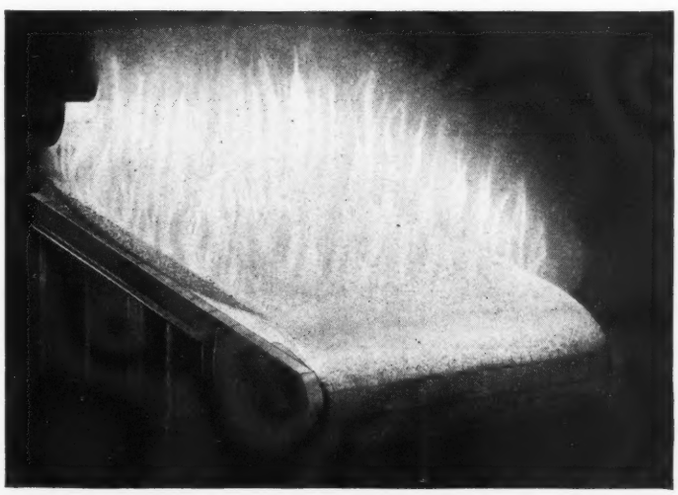


33% to 100% increased boiler outputs

with a minimum of new capital investment and minimum shut-down for change-over have been obtained with Stowe Stokers

For example, when a large automotive manufacturer took out a four year old stoker and put in a Stowe Stoker, he jumped the normal output of that boiler from 150% to 300% of rating, using the same coal, and the peak output from 200% to 400% of rating,—and has put in seven more Stowe Stokers since in his several plants. A large utility jumped the capacity of a unit from 75,000 lbs., which had been peak with the old equipment, to 135,000 lbs. with a Stowe Stoker. A large laundry, a salt company, and many others have secured outstanding results. The output of practically any five to fifteen year old plant can be increased substantially with a Stowe Stoker . . . with a minimum of down-time.



If you need more steam, investigate Stowe Stokers. Find out how easily they can be installed under your present boilers. Stowe Stokers will burn the entire range of bituminous and semi-bituminous coals, permitting you to change quickly from one coal to another as changing prices, interruptions to delivery, etc., make changes desirable. A new, fully descriptive catalog will be sent on request, or, let us arrange an inspection trip so you can see for yourself what restokering with Stowe Stokers will really do!

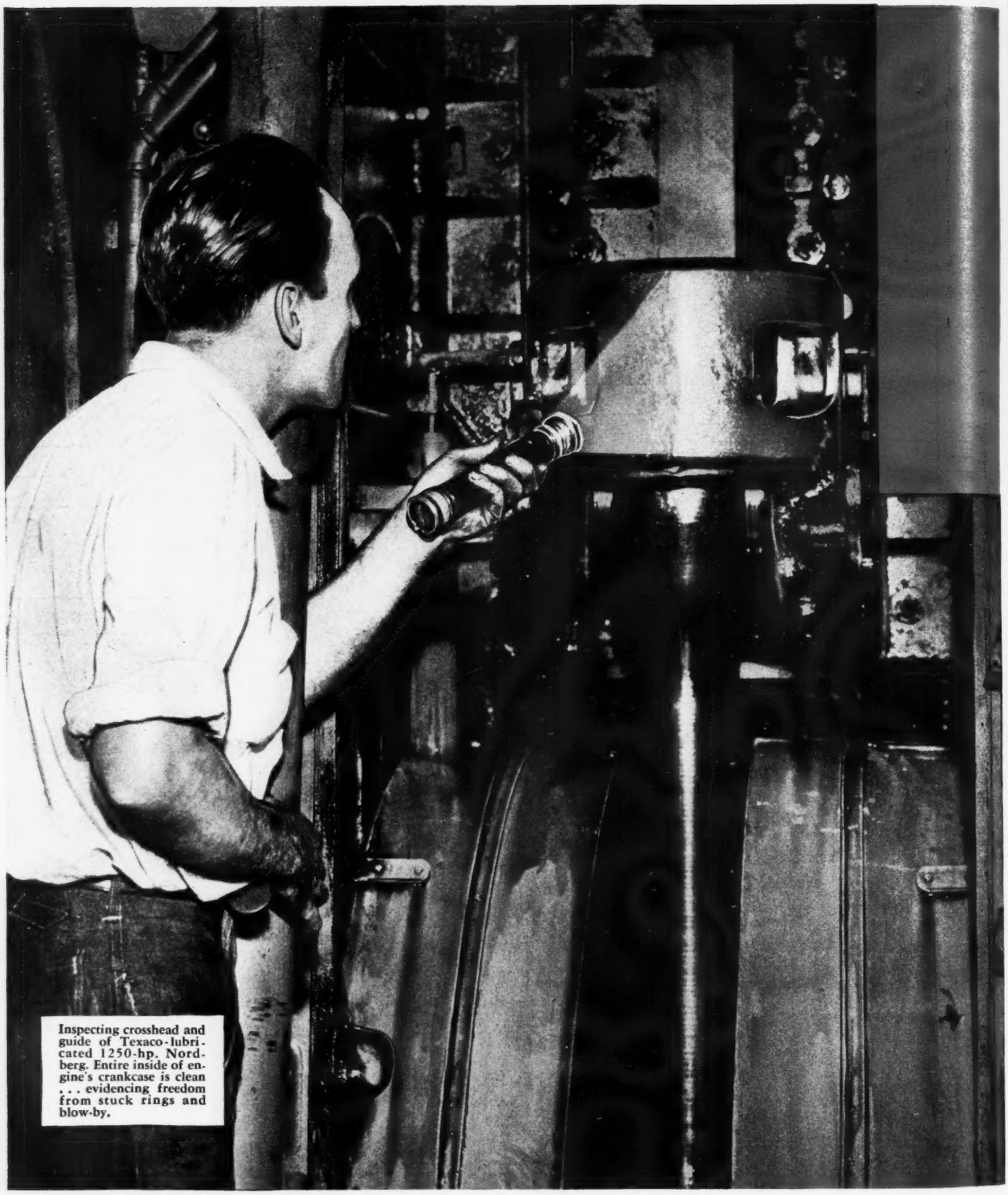
THE JOHNSTON & JENNINGS CO.

DETROIT — 878 Addison Road, CLEVELAND, OHIO — CHICAGO

Engineering and Sales Representatives in
New York • Pittsburgh • Kansas City • St. Louis

STOWE STOKERS

★ ★ GIVE YOU MORE STEAM FROM LESS COAL ★ ★



Inspecting crosshead and guide of Texaco-lubricated 1250-hp. Nordberg. Entire inside of engine's crankcase is clean . . . evidencing freedom from stuck rings and blow-by.

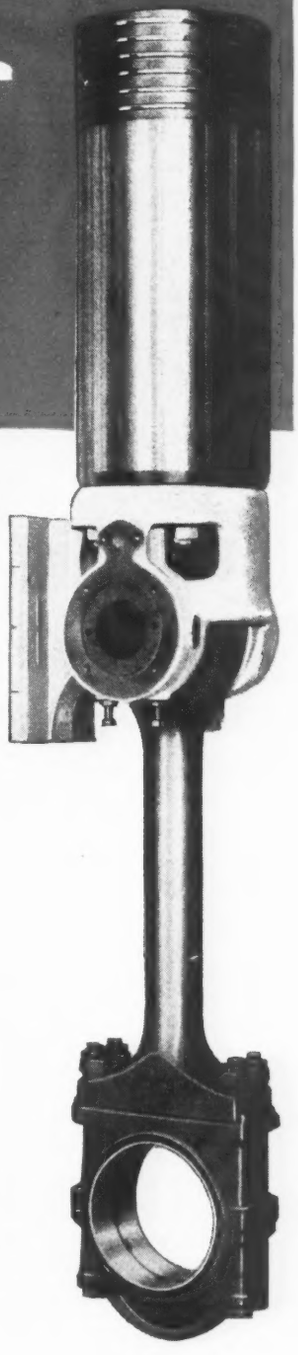
TEXACO

REG. T. M.

TEXACO

CLEAN CROSSHEADS

Evidence of Perfect Piston Seal



Piston, rod, and bearing assembly of Nordberg Diesel. Engine parts stay cleaner and freer from carbon, when lubricated with Texaco.

Crossheads, guides and crankcases stay CLEANER, freer from sooty deposits due to blow-by, when you use *Texaco Algol* or *Ursa Oils.*

Highly resistant to the formation of gum, sludge and hard carbon, these Texaco oils keep piston rings freer, valves cleaner, ports open, assuring maximum power and greater fuel economy. Result—

More stationary Diesel horsepower in the U.S. is lubricated with Texaco than with any other brand.

The outstanding performance that has made Texaco first in the stationary Diesel field, has made it first in the fields listed in the panel.

These Texaco users enjoy many benefits that can also be yours. A Texaco Lubrication Engineer will gladly cooperate . . . just phone the nearest of more than 2300 Texaco distribution points in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York, N. Y.

THEY PREFER TEXACO

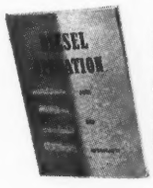
★ More revenue airline miles in the U. S. are flown with Texaco than with any other brand.

★ More buses, more bus lines and more bus-miles are lubricated with Texaco than with any other brand.

★ More stationary Diesel horsepower in the U. S. is lubricated with Texaco than with any other brand.

★ More Diesel horsepower on streamlined trains in the U. S. is lubricated with Texaco than with all other brands combined.

★ More locomotives and cars in the U. S. are lubricated with Texaco than with any other brand.



DIESEL OPERATION MANUAL. 96 pages of charts, diagrams, photographs and text, plus new section on special purpose Diesel lubricants and complete Diesel Lubrication Chart. Yours for the asking.

Care for your Car ..for your Country

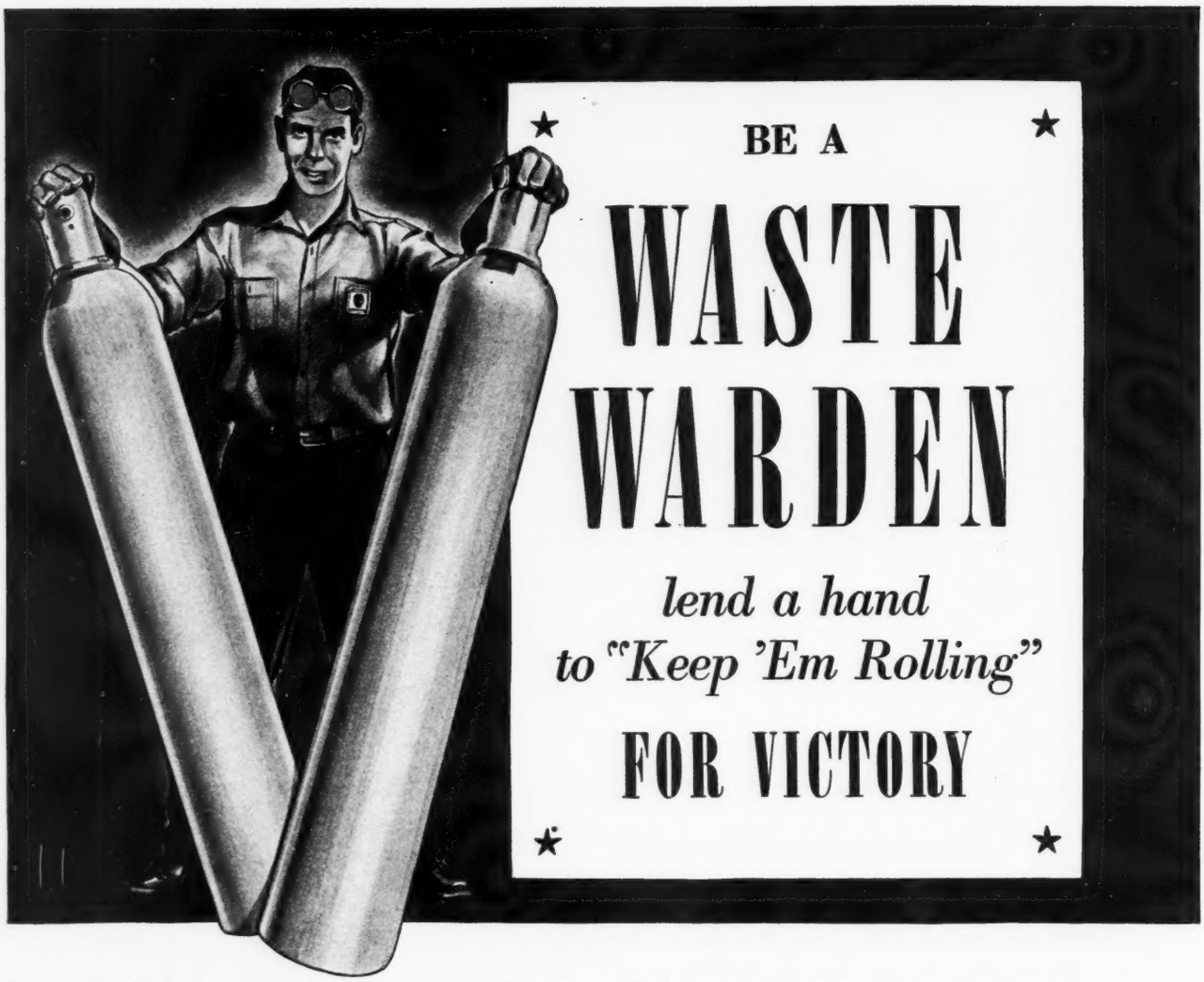
FOR YOUR ENJOYMENT

FRED ALLEN every Sunday night. See your local newspaper for time and station.

HELP WIN THE WAR BY RETURNING EMPTY DRUMS PROMPTLY

Lubricants and Fuels

FOR POWER PLANT EQUIPMENT



UNCONSCIOUS waste in this land of plenty can become a serious handicap in our war effort. Let's take a case in point — oxygen. This element is vital to the speedy production of tanks, trucks, guns, ships, planes, and shells.

Oxygen consumption continues to skyrocket and the bottleneck remains steel cylinders. They just can't be obtained fast enough. But, we can all help by making every cylinder most useful. Here's how:

Make yourself a Waste Warden. See that the cylinders keep rolling. Don't let them get tied up in inventory. Be sure that cylinders are shipped back promptly when they are empty — and be sure to get the most gas out of each cylinder. If you see to it that these and other "do" and "don't" suggestions are followed you will be making a worthwhile contribution to our war effort as well as helping yourself.

Join the "Waste Wardens". Keep the cylinders rolling.

WASTE WARDEN SAYS:

DO close cylinder valve after use.
DO check your hose and connections for leaks.
DO keep inventory low.
DO return empty cylinders promptly.
DO keep tips clean and free from carbon and slag.

DON'T use excessive pressure.
DON'T use oversize tip.
DON'T leave tip burning when not in use.
DON'T abuse cylinders.
DON'T leave cylinder valves open when gas is not being used.

Air Reduction

60 EAST 42nd ST., NEW YORK, N. Y.

IN TEXAS: MAGNOLIA-AIRCO GAS PRODUCTS CO.

AIRCO

WILSON

IDLE CYLINDERS ARE PRODUCTION SLACKERS: *Keep 'em rolling for victory!*

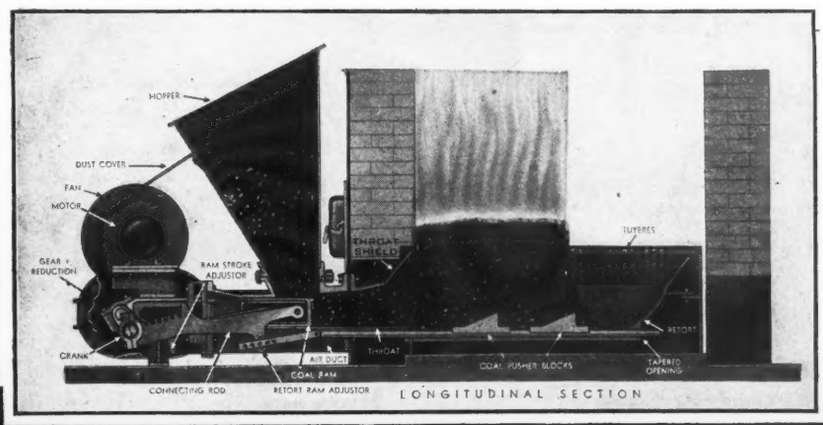
GENERAL MOTORS CORPORATION
COPPERWELD STEEL COMPANY
AMERICAN GAS & ELECTRIC COMPANY
EATON MANUFACTURING COMPANY
NORTON & COMPANY
E. I. DU PONT DE NEMOURS COMPANY
DEFENSE PLANT CORP., CORRY, PA.
TIMKEN ROLLER BEARING COMPANY
UNITED STATES WAR DEPARTMENT
COOPER-BESSEMER CORPORATION
SOUTHERN RAILWAY COMPANY
UNITED STATES HOUSING AUTHORITY
THE WEATHERHEAD COMPANY
CHICAGO, ROCK ISLAND & PACIFIC RY.
BLACK & DECKER ELECTRIC COMPANY
UNITED MILK PRODUCTS COMPANY
STANDARD BRANDS, INC.
TAYLOR-WINFIELD CORPORATION
ELECTRIC CONTROLLER & MFG. CO.
FERRO ENAMEL CORPORATION
UNITED STATES STEEL CORPORATION
GENERAL HOSIERY COMPANY
BOARD OF EDUCATION, PITTSBURGH, PA.
FOOD MACHINERY CORP.—PEERLESS PUMP DIV.
AMERICAN FORK & HOE COMPANY
GENERAL FIRE EXTINGUISHER COMPANY
TAYLORCRAFT AVIATION CORPORATION
HERCULES MOTORS CORPORATION

Famous Names IN INDUSTRY BUSINESS AND GOVERNMENT

ALL SATISFIED USERS OF

CANTON STOKERS

This representative group of twenty-eight CANTON STOKER *satisfied* users employ 129 stokers, and have repeated original orders *34 times!* An enviable record of service to these famous names, this . . . and it can be traced directly to CANTON'S specialized Stoker engineering and construction service and facilities. Backed by 31 years' experience in the manufacture of fuel burning equipment, CANTON STOKERS SAVE . . . numerous users will vouch for this. Each unit embodies those features that assure the highest return per dollar invested. Then, CANTON STOKERS are the *only* stokers guaranteed for FIVE YEARS . . . not only against defects, but WEAR as well. Get the CANTON STOKER story, and start to SAVE at once! Write for bulletins.



CANTON STOKER

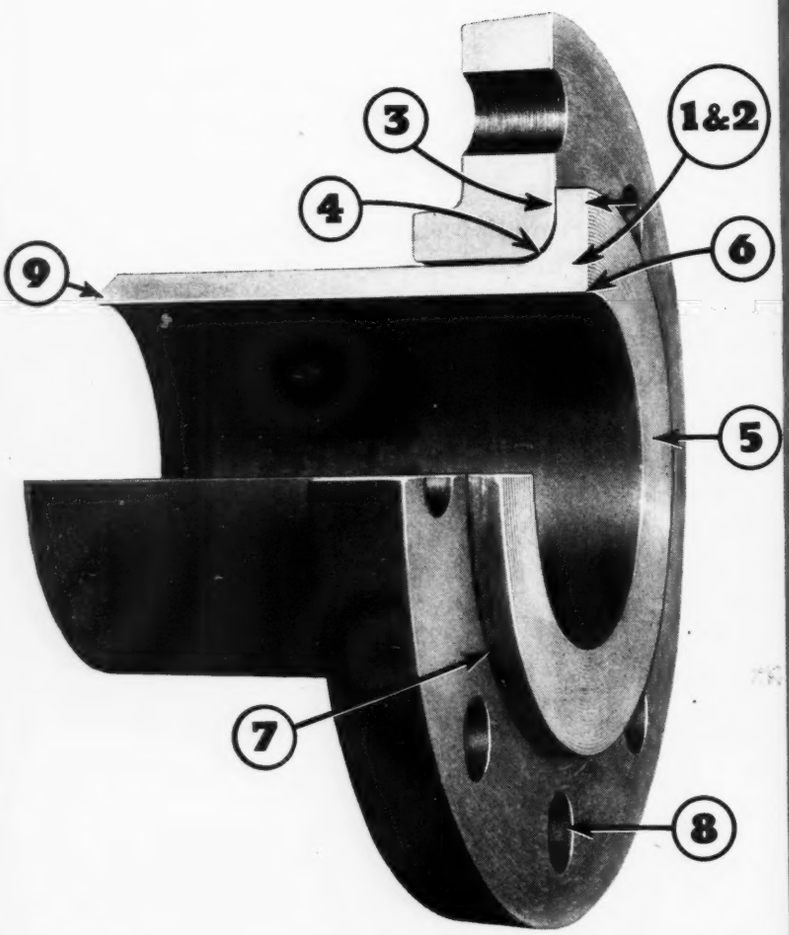
CANTON STOKER CORPORATION

ANDREW PLACE, S. W., CANTON, OHIO

MIDWEST

LAP-JOINT STUB ENDS

Have MANY ADVANTAGES



1. LAP IS FORGED—by a special Midwest process that simultaneously upsets the pipe and forms the lap. Tests have proved the superiority of this process.

2. STRESS RELIEVED—The metal in the lap is worked at a forging heat and then normalized to assure a uniform, close-grained structure. Photomicrographs show it frequently superior to the original pipe material.

3. HEAVY LAP—Thickness of finished lap (after machining front and back) is always at least equal to pipe wall thickness.

4. LARGE RADIUS FILLET—Assures more metal in the critical area of lap—where maximum total bending and shearing stresses occur. Advantages 3 and 4 are important factors in securing the greatest strength in the lap.

5. PHONOGRAPHIC FINISH—of lap face holds the gasket more securely.

6. SQUARE CORNER (instead of a round corner)—adds to lap strength but also eliminates pockets for accumulation of condensate and sediment that promote corrosion.

7. UNIFORM FLANGE BEARING—Back face of lap is carefully machined to assure the uniform flange bearing necessary to a satisfactory joint.

8. TIME SAVED—in both welding and erection because bolt holes need not be carefully lined up before welding.

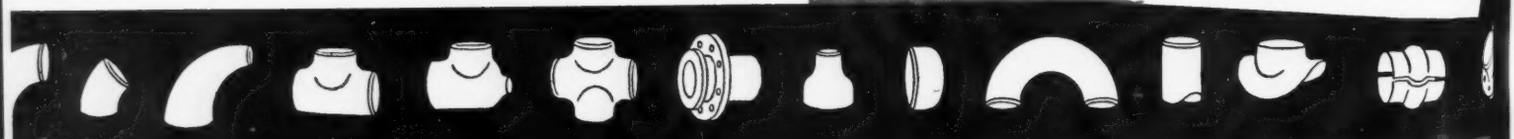
9. MACHINE BEVELED—The other end of the Stub End is accurately machined for easy welding.

See Bulletin WF-41 for complete data on Midwest Lap-Joint Stub Ends . . . and the other Midwest Welding Fittings that simplify and save on welded piping.

MIDWEST PIPING & SUPPLY CO., Inc.

Main Office: 1450 So. Second St., St. Louis, Mo.
Plants: St. Louis, Passaic (N. J.) and Los Angeles

Sales Offices: Houston—229 Shell Bldg. • Tulsa—533 Mayo Bldg.
Chicago—949 Marquette Bldg. • Los Angeles—520 Anderson St.
New York (Eastern Division)—30 Church St.
San Francisco—535 Call Bldg.



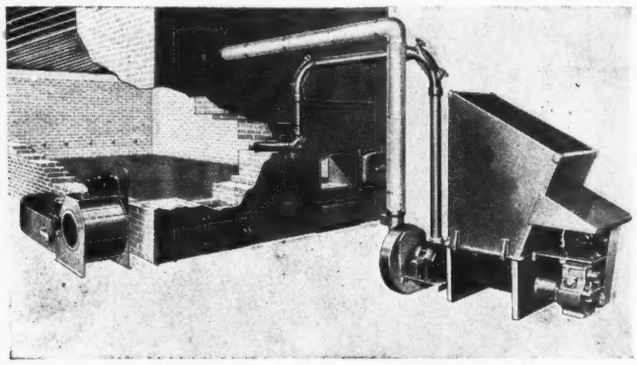
MIDWEST WELDING FITTINGS SAVE TIME, IMPROVE THE DESIGN, AND REDUCE THE COST OF PIPING SYSTEMS

IRON FIREMAN P.S.* STOKERS

★ *Pneumatic Spreader*

Produce More Steam for War Production

QUICKLY INSTALLED



This diagrammatic view shows the operation of the Iron Fireman Pneumatic Spreader stoker. Steam-size coal is conveyed from the hopper (at right) or bunker, to a transfer housing. Here the coal is picked up by a stream of high-velocity air and conveyed to the furnace and grates. The fines burn in suspension, utilizing the conveying air for combustion. The larger pieces form a shallow fuel bed on the grate. By means of an adjustable nozzle, the coal is distributed uniformly over the entire grate surface. Entering at right angles to the flow of under-grate air through the fuel bed, the conveying air produces maximum turbulence.

FOR increased "fire-power" in your plant, to speed America's all-out war of production, enlist Iron Fireman stokers. These self-contained stoker units are being quickly installed in boilers of all types, developing up to 1,000 h.p. They are conserving the nation's fuel supply by burning coal and are substantially reducing coal tonnage requirements. In addition, Iron Fireman stokers are stepping up steam output 10% to 35% in war production plants, and are making large savings in fuel costs.

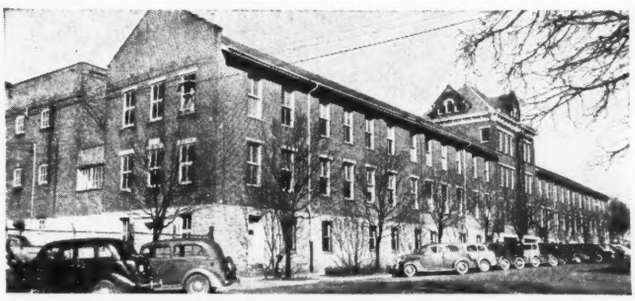
Iron Fireman stokers help eliminate "steam bottlenecks" by providing an ample and dependable supply of steam. They respond quickly to meet peak-load conditions, both in power and heating applications.

If you are faced with fuel changes or increased loads, why not find out now how quickly Iron Fireman equipment can be installed, and what it will accomplish in your plant?

A Typical Example of Iron Fireman Pneumatic Spreader Performance

Textile Plant Doubles Production

Uses Same Boilers with P. S. Firing. War orders have more than doubled the production of the American Pad & Textile Co., Greenfield, Ohio . . . yet the plant has been able to operate with the same boilers as before, and with no increase in fuel costs.



Plant of American Pad & Textile Co., Greenfield, Ohio.

W. O. SKEEN
Mechanical Engineer, American Pad & Textile Co.

This record has been made possible by three Iron Fireman Pneumatic Spreader Stokers in the 200 h.p. boilers.

W. O. Skeen, mechanical engineer of the plant, reports: "The Iron Fireman Pneumatic Spreader is able to hold the steam pressure practically constant, even with widely fluctuating loads.

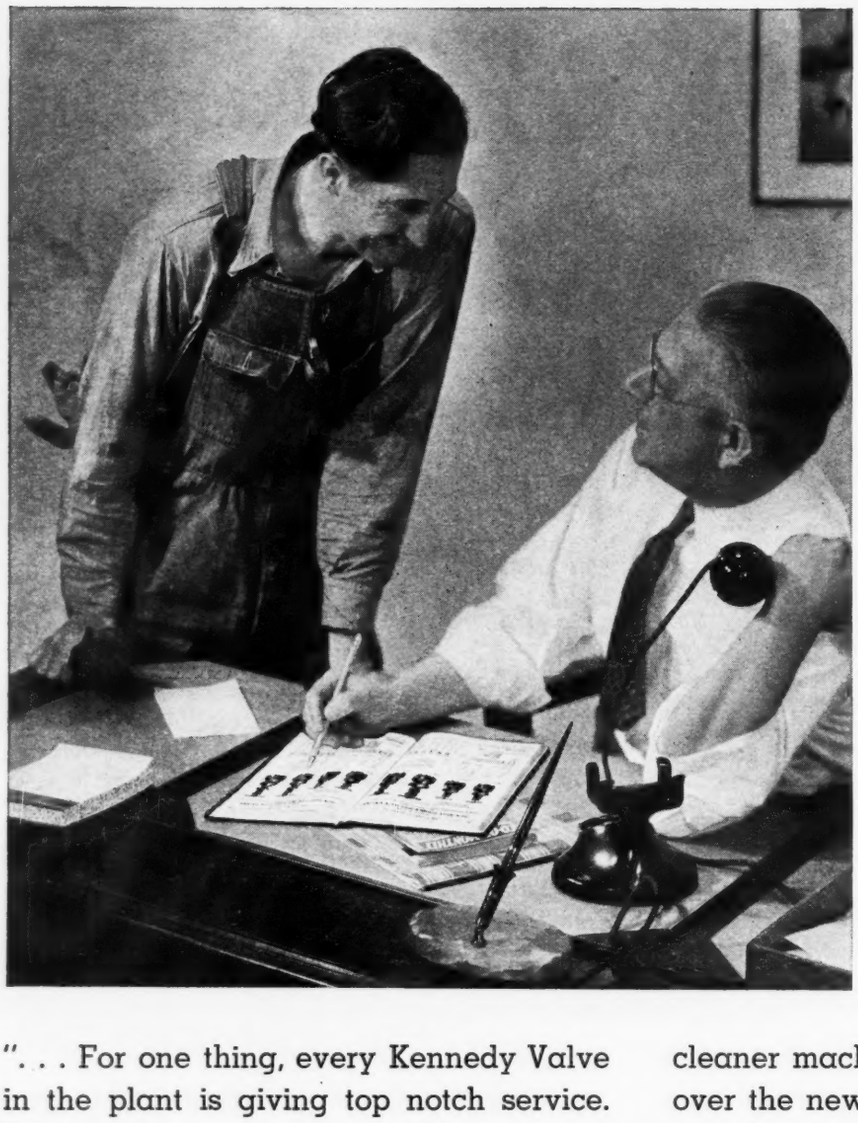
"The upkeep cost of furnaces has been reduced more than 50%, owing to the elimination of the cutting effect of the air blast on the sidewalls, caused by the previous type of firing unit, which the spreader type replaced.

"Cleaning of ash from the grates is done in a few minutes, under full load, without loss of steam pressure. With the previous unit, there was a very considerable loss of coke, and cleaning had to be done at times of reduced demand for steam."

☆ ☆

Learn what Iron Fireman firing can accomplish for *you*. We are ready to make an immediate engineering survey of your steam plant, in cooperation with your own plant or consulting engineer. No cost or obligation. Write Iron Fireman Manufacturing Co., 3305 W. 106th Street, Cleveland, Ohio.

IRON FIREMAN AUTOMATIC COAL STOKERS



"WHY DO YOU FELLOWS ALWAYS ASK FOR KENNEDYS"

". . . For one thing, every Kennedy Valve in the plant is giving top notch service. We have had some for over 15 years, and they still open easily and close tightly . . . never had a minute's trouble with them. Then again, did you ever look closely at a Kennedy Valve? Well, I have, and I never saw huskier designs, finer metal and cleaner machining. We were just looking over the new Kennedy Catalog, and saw exactly the kind of valves we should have in that new plant we're building."

The new Kennedy Catalog describes the entire line of bronze and iron body valves of all standard types, also malleable iron, bronze and cast iron pipe fittings. Write for your copy.

THE KENNEDY VALVE MFG. CO.
ELMIRA • NEW YORK

KENNEDY *valves . . . pipe fittings . . . fire hydrants*

These 2 Words MAKE MOTOR-DRIVE *More than* POWER!

RELIANCE ELECTRIC AND ENGINEERING COMPANY

Motor-drive provides within itself a means of:

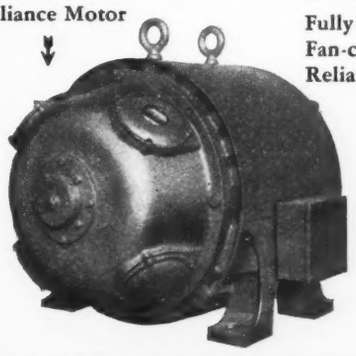
SPEED CONTROL	REVERSING
BRAKING	REMOTE CONTROL
TANDEM OPERATION	CONTROLLED ACCELERATION
TENSION CONTROL	SAFETY

SLOW SPEEDS FOR INCHING, THREADING, INSPECTION

Applying them to boost production and improve quality is APPLICATION ENGINEERING. That's our business.

Reliance men skilled in Application Engineering start daily on new missions essential to making our great war machine produce more than we ever dreamed was possible. They are answering calls where *motor-drive must be more than power.* These are typical . . . A new tinning process to make our reduced tin supply go three times as far . . . A drive to simplify machine design and insure a top-notch production pace on a hurry-up lot of hundreds of boring mills for producing tank turrets . . . Motors to speed up production of shell-turning lathes . . . A motor-drive for an automatic towing machine that will aid sea-going tugs to handle tows with less strain and reduce chances of losing the tow . . . A hoisting motor for bringing seaplanes to a warship's deck safely in rough seas...These and many more like them are engineering jobs done in cooperation with men who *start* their design with the question, *"What can we get the motor to do besides supply power?"* Such as:

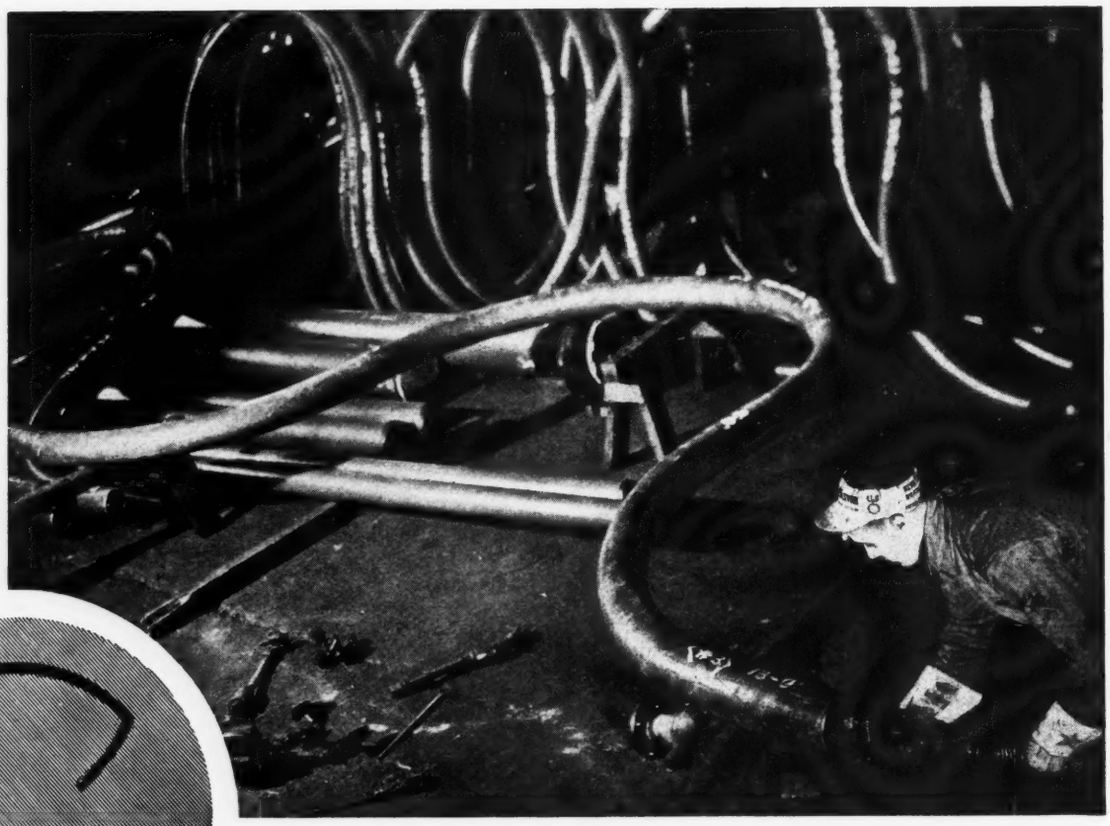
Fully-enclosed, Fan-cooled D-c. Reliance Motor



Fully-enclosed, Fan-cooled A-c. Reliance Motor

RELIANCE ELECTRIC & ENGINEERING COMPANY
1088 IVANHOE ROAD • CLEVELAND, OHIO
BIRMINGHAM • BOSTON • BUFFALO • CHICAGO • CINCINNATI
DETROIT • GREENVILLE, S.C. • HOUSTON, TEX. • LOS ANGELES
MINNEAPOLIS • NEW YORK • PHILADELPHIA • PITTSBURGH
PORTLAND, OREGON • ST. LOUIS • SAN FRANCISCO
SYRACUSE, N.Y. • AND OTHER PRINCIPAL CITIES

RELIANCE A-C D-C MOTORS



Craftsmanship

NAVCO

POWER PLANT PIPING

• The bending of pipe is an operation which requires considerable more skill than is evidenced by mere observation.

Of great importance is the manner in which the pipe is prepared to insure the finished bend having a smooth, clean inner surface free of embedded impurities, wrinkles or buckles.

For hot bending, Navco shops are equipped to mechanically ram a special grade of sand compactly in the pipe, thus insuring a minimum amount of thinning in the outside wall.

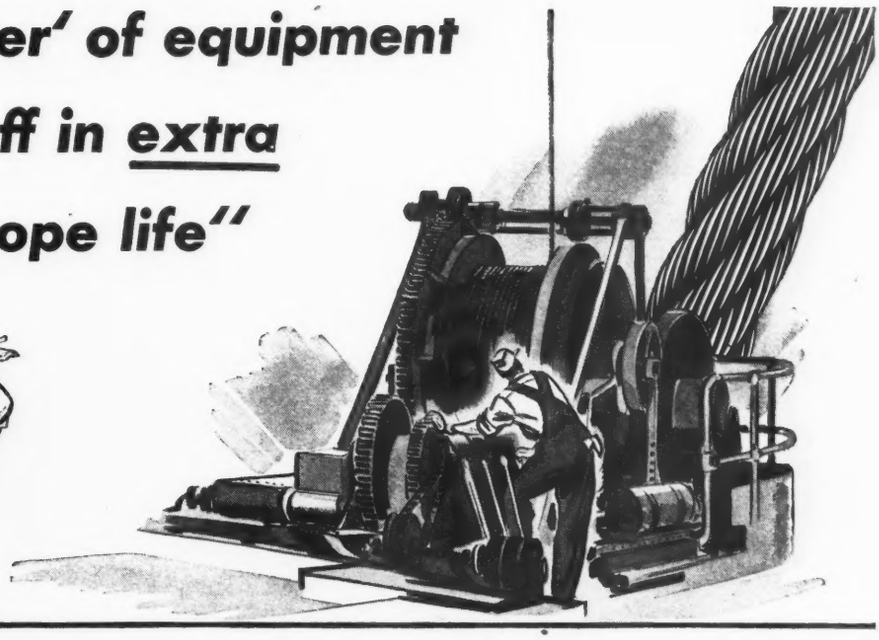
Before shipment, every Navco pipe bend is internally turbined with tube cleaner to remove all traces of sand or scale. Where such scale and sand is not removed, it will frequently loosen up in service and destroy turbine blading and valve seats, clog traps and in short, impair the operation of any mechanical equipment to which the piping system is connected.

Every pipe bend and every piece of piping material turned out by Navco shops is of a distinctly superior type of craftsmanship. It has been fabricated by master craftsmen.

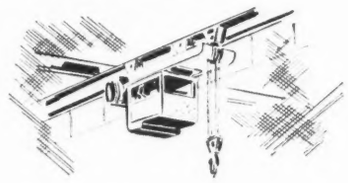
NATIONAL VALVE & MFG. CO., PITTSBURGH, PA.

[ATLANTA BUFFALO CLEVELAND CHICAGO NEW YORK PHILADELPHIA]

"This 'once-over' of equipment pays off in extra wire rope life"



"If you're out to get a full measure of service from your wire ropes, it's just good, common sense to check the equipment it runs on. Not just when you get around to it, but regularly—carefully and often. Make a close check-up when a new rope is installed ...and then check again, frequently—*before* the rope starts to show signs of wear. Take a crane, for example, with a worn sheave.



It will go right along handling every bit of work it always did. But that sheave will cut and squeeze the wires ...and the rope will be through, long before its time.

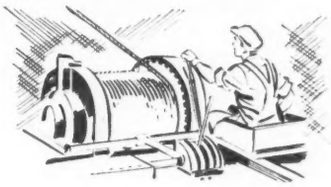
Here are some of the things to look for—some of the reasons why you often hear an operator blame the rope when it was really his own equipment that shortened its life.

First, see if any sheaves are out of alignment. Then check for deeply worn grooves with a gauge,—like this...

The grooves may be scored by an old rope or one of them may have a broken rim that calls for replacement. Sheaves may turn hard or wabble because of worn or damaged journals. That's tough on your ropes, too.

It's easy to realize the jerk or shock at the fastening when a wire rope whips. Vibration has the same kind of effect, building up a great many small shocks. Too much play in the rope may be to blame...even a bent shaft.

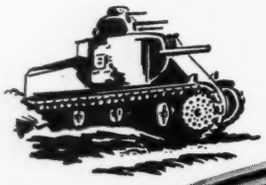
Check for displaced or faulty rope guards. Then find out from the operators if there are any clutches that stick or grab...loose bearings or anything else that causes the pull on a rope to be uneven or jerky.



And remember to consult your wire rope manufacturer on any special problems. There are local representatives near you who have practical experience in ferreting out any "bugs" in your equipment that may be keeping your wire ropes from delivering a maximum of service."

JOHN A. ROEBLING'S SONS COMPANY
TRENTON, NEW JERSEY
Branches and Warehouses in Principal Cities

ROEBLING
"Blue Center"
STEEL WIRE ROPE
PREFORMED OR NON-PREFORMED



Vital LINKS for All-Out Production

MORSE

SILENT and ROLLER CHAIN DRIVES

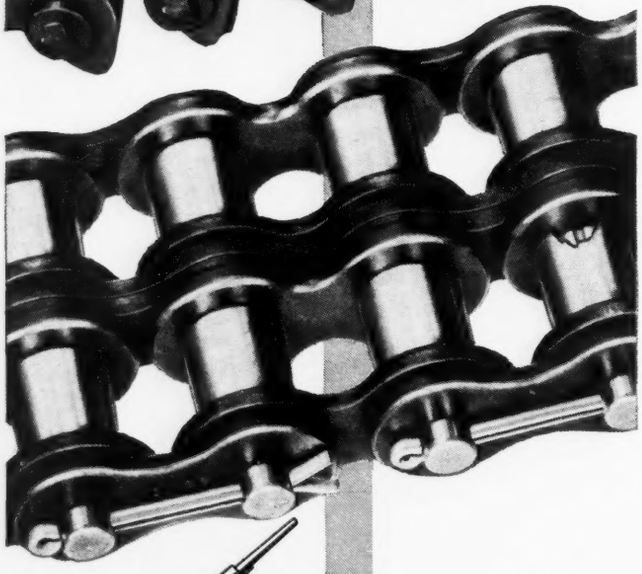
Meet Every Demand
No Slip—No Power Waste

Power drives are vital in today's production rush. Beware of inefficient drives that cut down production through slippage and power waste.

Take advantage of Morse Silent and Roller Chain Drives. Their compact design, rugged construction and proven performance are your assurance of efficient power transmission and peak production. Smooth, dependable in operation, they set new records of trouble-free, economical service.

Morse Silent Chain Drives embody the famous patented "Rocker Joint" that rolls, not slips, the load—resulting in minimum resistance and wear for maximum efficiency and long life.

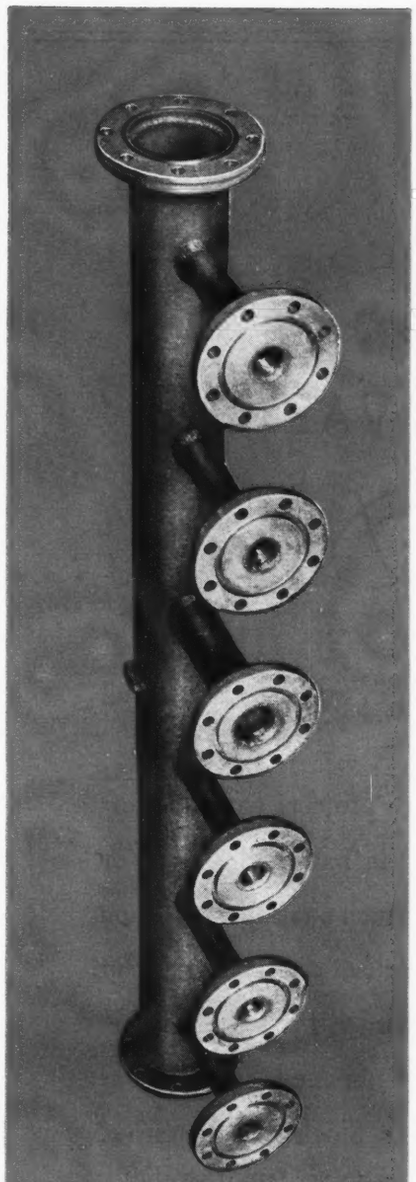
The Morse man in your territory will gladly assist in any of your drive problems—call him.



SILENT CHAINS ROLLER CHAINS FLEXIBLE COUPLINGS CLUTCHES

MORSE *positive* DRIVES

MORSE CHAIN COMPANY ITHACA N. Y. DIVISION BORG-WARNER CORP.



IMPORTANT

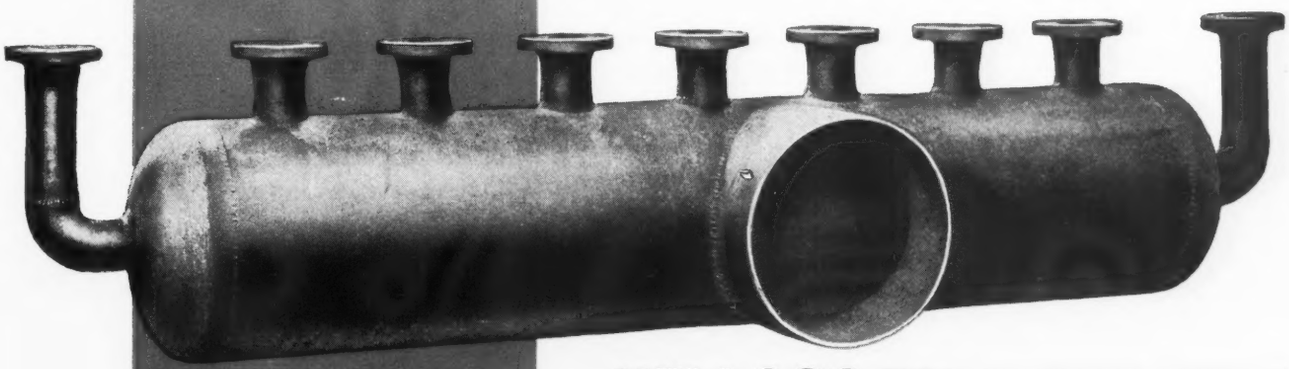
6 IN. OR 30 IN.

THE QUALITY IS THE SAME

Kellogg prefabricated piping assemblies, simple as those shown here, or as intricate as required for the most individual conditions — ranging in pressure from 200 to 2200 pounds—are installed in various power plants in this country.

Accurately prefabricated and thoroughly tested in the Kellogg shops these assemblies are shipped ready to connect, saving time and money on the job.

In fact, consulting engineers, operators of central stations, industrial and marine power plants, find that pinning the responsibility for piping on The M. W. Kellogg Company is the most satisfactory solution to their problems.



KELLOGG **THE M. W. KELLOGG COMPANY**
JERSEY CITY, N.J. · 225 BROADWAY, N.Y.
Representatives:
LOS ANGELES: 609 SOUTH GRAND · TULSA: PHILTOWER BLDG.

"Masterflex" Prefabricated Piping Systems · **"Masterweld"** pressure vessels for Power, Refinery and Chemical Industries. Heat Exchangers. Pyrolytic and Catalytic Cracking Units, Reforming, Dehydrogenation, Alkylation, Desulphurization. Thermal and Catalytic Polymerization Units · **JUIK** Processes for Lubricating Oil Plants. Plastic Refractories · Radial Brick Chimneys.

Concerning ★ ★ ★

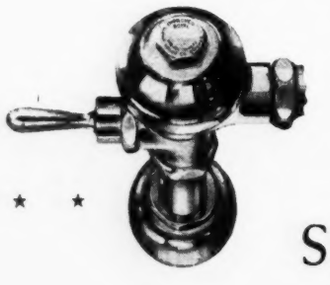
SLOAN FLUSH VALVE

Deliveries ★ ★ ★

Immediate delivery of Sloan Flush Valves can still be made to all who are entitled to buy and install them.

Those who have that right are those with projects having priority ratings of A-10 or better—and those in national defense or war production work qualified to apply for such a rating. Minimum purchases for building maintenance and repair can also be made if in conformity with the maintenance and repair order. For specific information on how Sloan Flush Valves may be obtained, consult your nearest plumbing supply distributor or your Sloan representative.

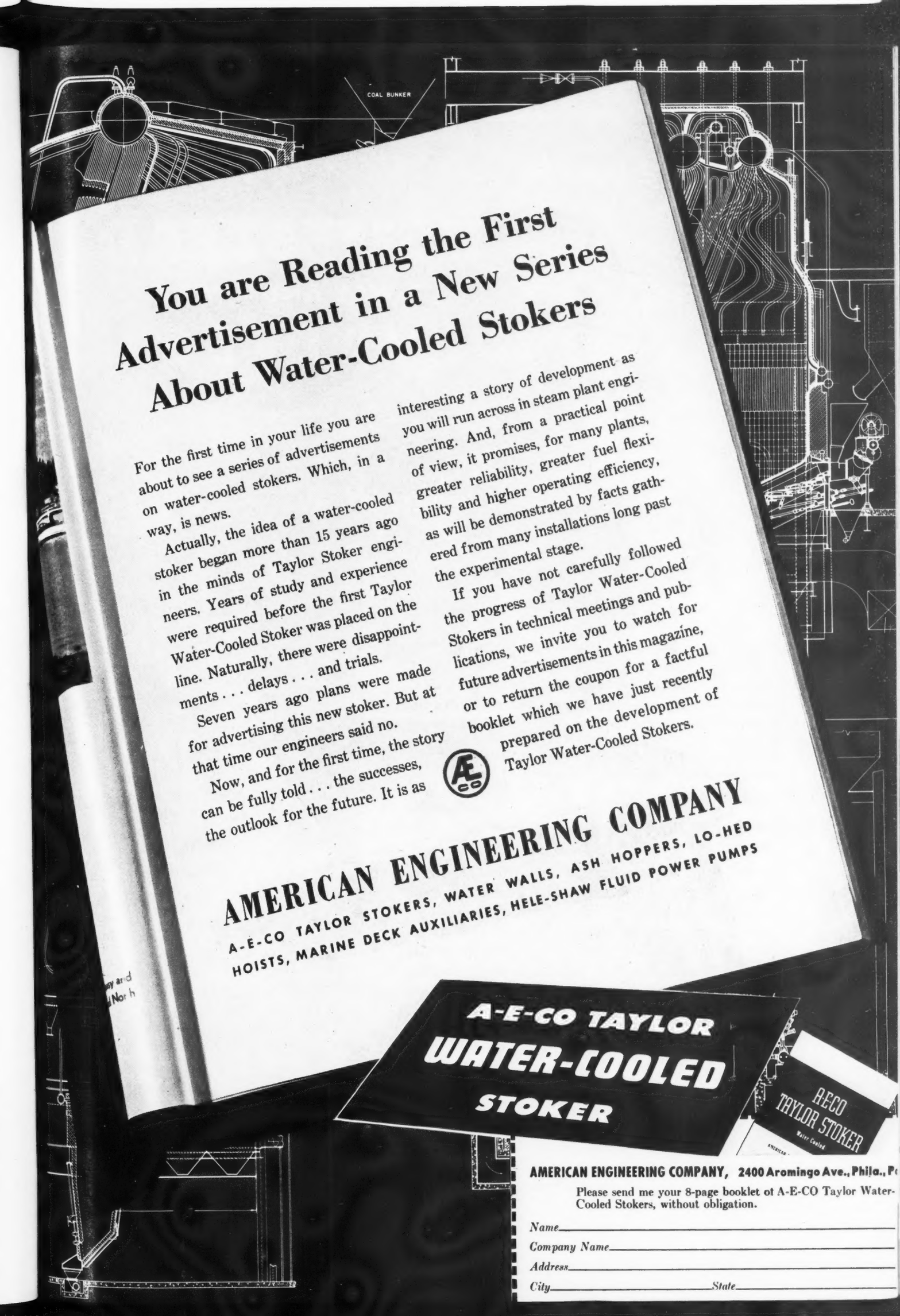
Sloan Flush Valves are still promptly available to all those who qualify under the above rules of the War Production Board. Don't merely ask for "flush valves"—ask for SLOAN Flush Valves—the kind which, in War or in Peace, enjoys a larger sale than all other makes combined. Whether you buy or specify, say: SLOAN FLUSH VALVES.



★ ★

SLOAN VALVE COMPANY

4300 WEST LAKE STREET • CHICAGO



You are Reading the First Advertisement in a New Series About Water-Cooled Stokers

For the first time in your life you are about to see a series of advertisements on water-cooled stokers. Which, in a way, is news.

Actually, the idea of a water-cooled stoker began more than 15 years ago in the minds of Taylor Stoker engineers. Years of study and experience were required before the first Taylor Water-Cooled Stoker was placed on the line. Naturally, there were disappointments . . . delays . . . and trials.

Seven years ago plans were made for advertising this new stoker. But at that time our engineers said no.

Now, and for the first time, the story can be fully told . . . the successes, the outlook for the future. It is as interesting a story of development as you will run across in steam plant engineering. And, from a practical point of view, it promises, for many plants, greater reliability, greater fuel flexibility and higher operating efficiency, as will be demonstrated by facts gathered from many installations long past the experimental stage.

If you have not carefully followed the progress of Taylor Water-Cooled Stokers in technical meetings and publications, we invite you to watch for future advertisements in this magazine, or to return the coupon for a factful booklet which we have just recently prepared on the development of Taylor Water-Cooled Stokers.

AMERICAN ENGINEERING COMPANY

A-E-CO TAYLOR STOKERS, WATER WALLS, ASH HOPPERS, LO-HED HOISTS, MARINE DECK AUXILIARIES, HELE-SHAW FLUID POWER PUMPS

A-E-CO TAYLOR WATER-COOLED STOKER

AMERICAN ENGINEERING COMPANY, 2400 Aramingo Ave., Phila., P

Please send me your 8-page booklet of A-E-CO Taylor Water-Cooled Stokers, without obligation.

*Name*_____

*Company Name*_____

*Address*_____

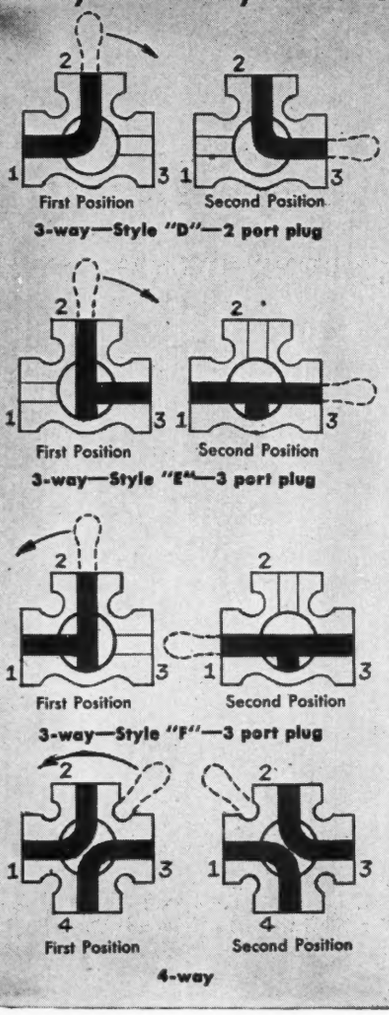
*City*_____ *State*_____

You Save in Two Ways by Using

HOMESTEAD

3-WAY AND 4-WAY VALVES

Fluid flow-lines show how you can use HOMESTEAD 3-way and 4-way VALVES



• It's double economy to use 3-way and 4-way Homestead Quarter-Turn Valves as flow changers on steam, water, oil, air, gas, or chemical lines; or to operate single-acting or double-acting hydraulic pistons which do not require a mid-position shut-off.

YOU SAVE in first cost, maintenance and operating time by requiring fewer valves and fittings.

YOU SAVE by getting Homestead's typical, long, trouble-free operation, and extremely low cost-per-year valve service.

These valves are available in sizes from ½-inch to 12-inch, cast in bronze, acid-metal, semi-steel, steel, Monel, Ni-Resist, or special alloys for specific jobs; for temperatures to 1000 degrees F. and corresponding pressures... Get this double economy on your next valve job, by specifying and ordering Homestead 3-way and 4-way Quarter-Turn Valves.

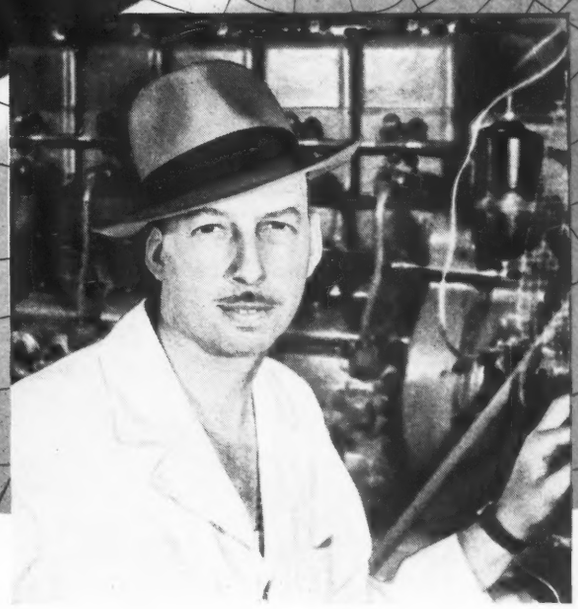
Reference Book No. 38 gives complete information about these, and all other Homestead Valves... Write for your free copy today.

HOMESTEAD VALVE MFG. CO.

P. O. BOX 210 • • • CORAOPOLIS • • • PENNSYLVANIA

MAKERS OF "PEAK PERFORMANCE" VALVES FOR 50 Years 1892 1942

This wrench has been idle for 11,000 hours



Gus Zimmerman's wrench has not always led such an easy life. As chief engineer for the Galland Laundry in San Francisco, Mr. Zimmerman's job is to take care of all the intricate machinery in a plant that uses 118,252,000 gallons of water and 1,665,000 gallons of soap per year. A very important part of that machinery is a big Diesel-generator set that handles the juice for the night shift.

For some reason that nobody could figure out, that engine kept Mr. Zimmerman's wrench busy. For the first two years of its life it only averaged 2700 hours between overhauls. Rings stuck, cylinder wear was high, gum and carbon stuck the valves, and the din it made carried across the street.

At this point it is probably better to let Mr. Z. do the talking:

"Yes, we tried out RPM DELO, and frankly I wasn't sure it would make a great deal of difference. But it did. We haven't had a stuck ring or stuck valve—and the engine is so quiet now you can carry on a normal conversation right beside it. But what counts most is it has run 11,000 hours without my putting a wrench to it and it is still going strong."

RPM DELO
REG. TRADE-MARK
DIESEL ENGINE LUBRICATING OIL

ORDER RPM DELO FOR YOUR DIESELS

RPM DELO is marketed under the following names:

RPM DELO
Calso Diesel Engine Lubricating Oil · Sohio RPM DELO · Caltex RPM DELO
Kyso RPM DELO · Signal RPM DELO · Imperial-RPM DELO (concentrate)

Ask your Diesel engine manufacturer or distributor for the RPM DELO supplier in your vicinity.

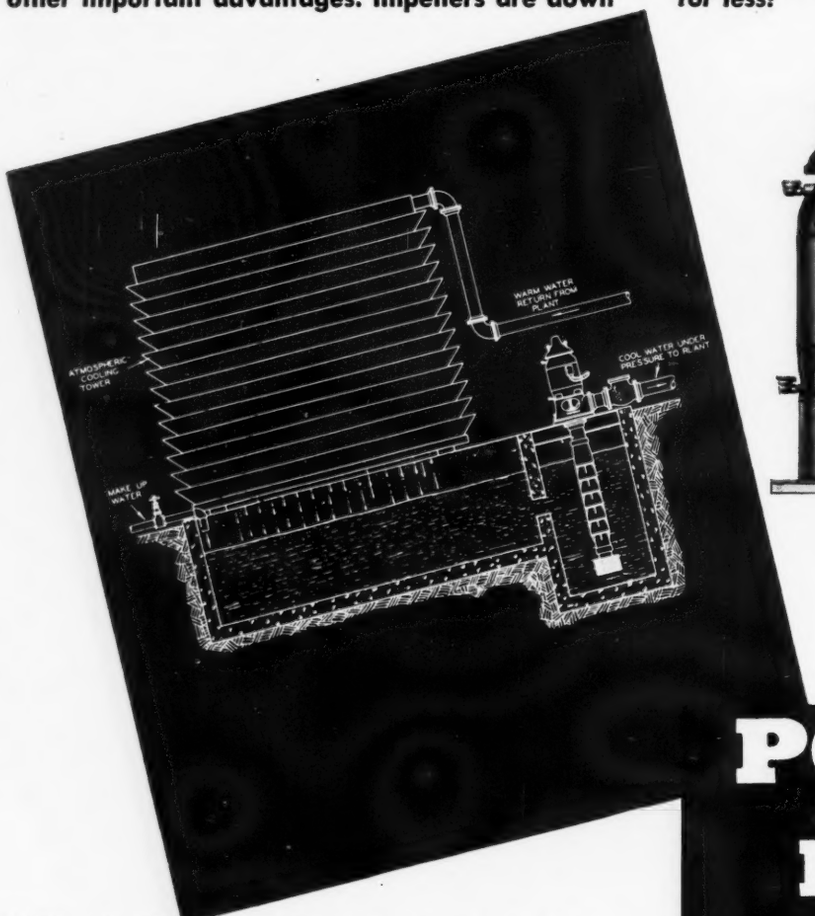
STANDARD OIL COMPANY OF CALIFORNIA

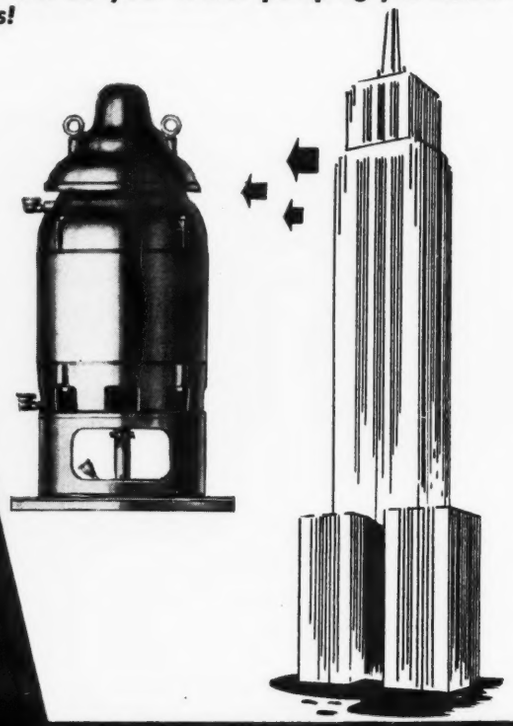
Why waste costly plant space WITH PUMPS OF OUTMODED DESIGN?

POMONA VERTICAL PUMPS are as compact and space-saving as a modern skyscraper. Instead of wasting valuable floor space with complicated piping...and with shafting, motor and pump spread "broadside"...Pomona Pumps operate *vertically*. They require only the small compact space occupied by the motor head. Shaft and pump impellers are down in the sump or tank, completely out of the way.

This not only saves costly plant space, but provides other important advantages. Impellers are down below water level, instantly ready to go *without priming*. Shaft and bearings are in the water stream, completely lubricated by the water being pumped, eliminating maintenance and oiling at these points. And the piping is simplified, for the discharge can be placed at, above—or *below*—floor level . . . wherever is most convenient for maximum compactness and plant efficiency.

Find out today the many ways Pomona Vertical Pumps will do your water pumping job better—for less!





POMONA
Water-Lubricated
PUMPS

COOLING AND CIRCULATING: *Illustrated above is a typical Pomona cooling pump installation. Note how Pomonas save space and eliminate complicated and expensive pipe layouts. What's more, they are easily adjustable for varying head requirements with proportionate savings in power . . . they may be installed in the open without need for housing—in basements, on roofs, over tanks or reservoirs wherever is most convenient . . . and, because they are lubricated by the water being pumped, constant care and attention are eliminated.*

POMONA PUMP CO., 120 Broadway, New York City
Plants located at 4301 South Spring Avenue, St. Louis, Missouri, and 206 Commercial Street, Pomona, California

BROWN TRIPLE AID for "ALL OUT" PRODUCTION

IN manufacturing tools of war — *Quality* and *Quantity* are essential to Victory.

If your plant is confronted with new and intricate process control problems of war production involving temperature, pressure, flow and liquid level — you can rely on Brown *Triple Aid* to standardize quality and speed-up production.

1. *Engineering:* Brown and Minneapolis-Honeywell engineers are qualified to recommend the control system best suited to your requirements — either electric — pneumatic or combined electric and pneumatic. Intimate knowledge of process control is based upon years of practical experience in the field — backed by a large organization with competent research facilities.

2. *Instrumentation:* For precision measurement and control, Brown Indicators, Recorders and Controllers are designed to work singly for the control of a variable or complete co-ordinated control of continuous processes.

3. *Nation-wide Service:* Brown Periodic Instrument Service is flexible and adaptable to the needs of your plant. The Brown Sales and Service Organization is Nation-wide. Offices are strategically located to render emergency repairs, regular inspection service or counsel.

Thousands of industrial plants are profiting by this invaluable Brown *Triple Aid*. You, too, can benefit by calling a Brown representative, located in all principal cities.

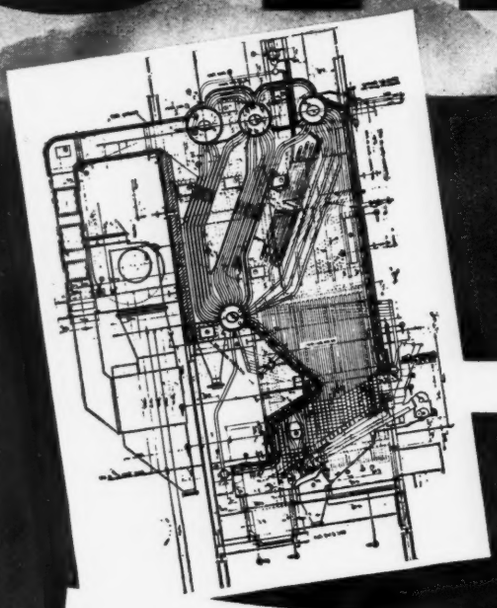
For Temperatures . . . . . Pressures . . . . . Flows . . . . . Liquid Levels

BROWN INSTRUMENTS

ELECTRIC • AIR OPERATED

THE BROWN INSTRUMENT COMPANY, 4490 WAYNE AVENUE, PHILADELPHIA PENNSYLVANIA
DIVISION OF MINNEAPOLIS-HONEYWELL REGULATOR CO.
MINNEAPOLIS, MINNESOTA, AND 119 PETER STREET, TORONTO, CANADA
Wadsworth Road, Perivale, Middlesex, England. Nybrokajen 7, Stockholm, Sweden

STEAM *for*

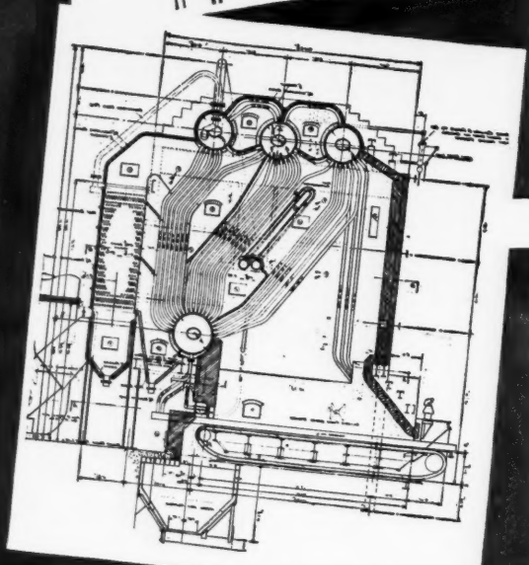


POWER

SOUTHERN COLORADO POWER COMPANY
Pueblo, Colo.

90,000 lbs. steam per hour Vogt LE type bent tube boiler with underfeed stoker. Water walls and economizer. Design pressure 525 lbs. Total steam temperature 750 degrees F.

•

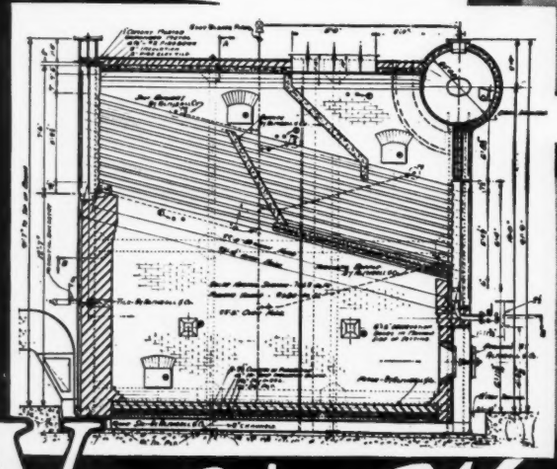


PROCESS

IN A LARGE MID-WESTERN STEEL MILL

Two 105,000 lbs. steam per hour Vogt LE type bent tube boilers with chain grate stokers and economizers. Design pressure 225 lbs. Total steam temperature 550 degrees F.

•



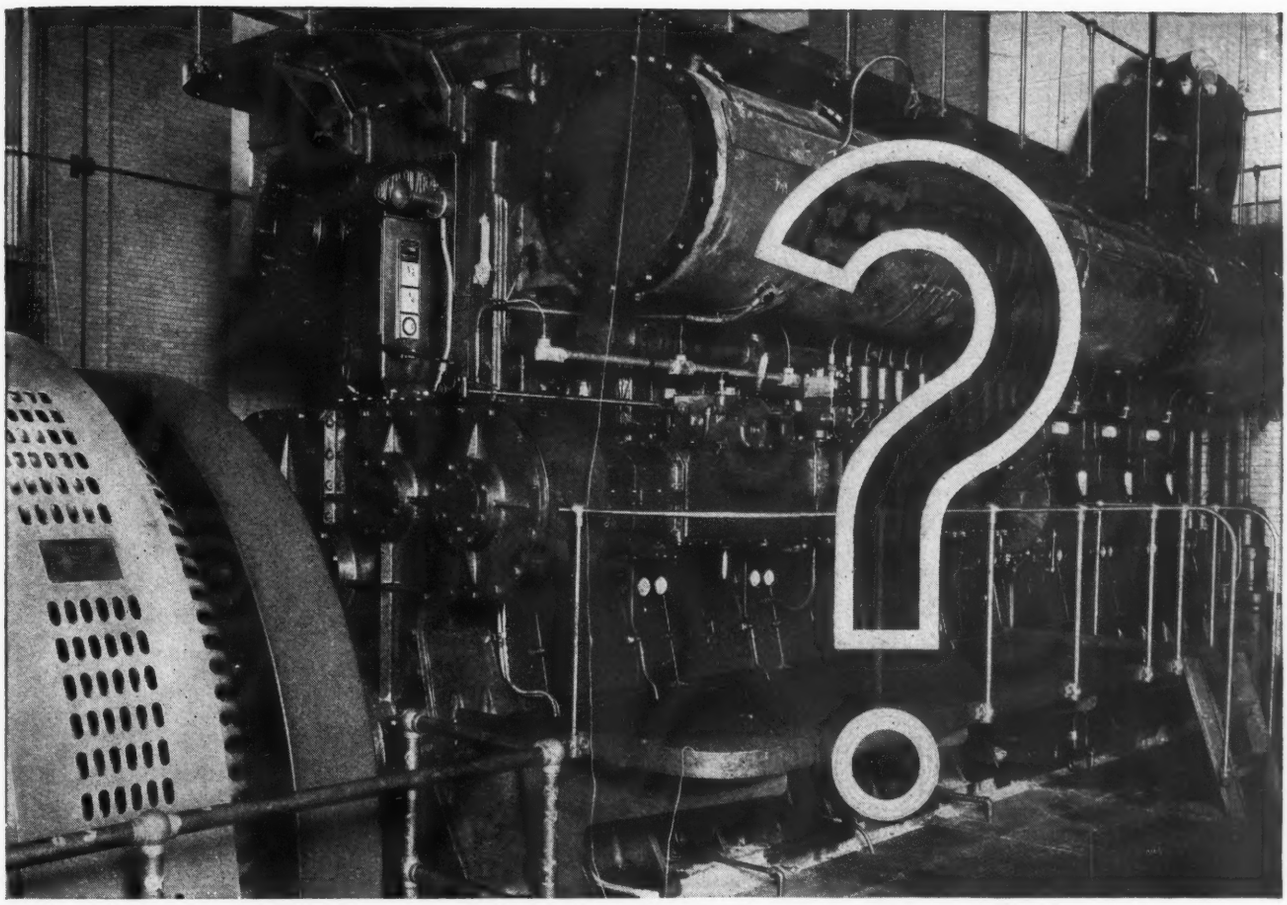
HEATING

CRIMINAL COURTS BUILDING AND JAIL
New York City

Four Vogt sectional header type boilers of 47,000 lbs. steam per hour capacity, oil fired. Design pressure 200 lbs.

HENRY VOGT MACHINE CO.
LOUISVILLE, KENTUCKY
Branch Offices: NEW YORK CLEVELAND
CHICAGO PHILADELPHIA TULSA

Vogt *Water Tube* BOILERS
BENT TUBE AND SECTIONAL HEADER TYPES



IF YOU HAVE A DIESEL ENGINE—
YOU HAVE A DIESEL ENGINE PROBLEM!

Problem? Say...if you're like most of us these days, you've got *plenty* of problems.

Your Diesels probably are working overtime . . . and you have to make them *last*. Replacement parts are hard to get when there's a war going on!

That's why we'd like to suggest that you see a Cities Service lubrication engineer at your earliest opportunity. He understands your particular problems. He knows how to solve them easily, quickly and at reasonable cost.

Above all, don't risk using unknown, experimental oils at a time like this. They can do real damage.

Let a Cities Service lubrication engineer recommend a service-proved oil for your particular job. It will save you money.

Call a Cities Service lubrication engineer today!

Meantime, you'll find much useful information in our booklet, "Diesel Engine Lubrication." We shall be glad to send it to you with the compliments of Cities Service.

Fill out and mail the coupon below today.

OIL IS AMMUNITION — USE IT WISELY!

CITIES SERVICE OILS
ONCE-ALWAYS

Write to —
CITIES SERVICE OIL COMPANY
Room 1326, Sixty Wall Tower, N. Y.
or any of the following offices:
CHICAGO . CLEVELAND . ST. PAUL
KANSAS CITY . BOSTON . TORONTO
or to
ARKANSAS FUEL OIL COMPANY
SHREVEPORT . ATLANTA . BIRMINGHAM

Please send me information concerning your Engineers' Lubrication Service. ☐

Please send me your booklet on "Diesel Engine Lubrication." ☐

Name_____

Firm name_____

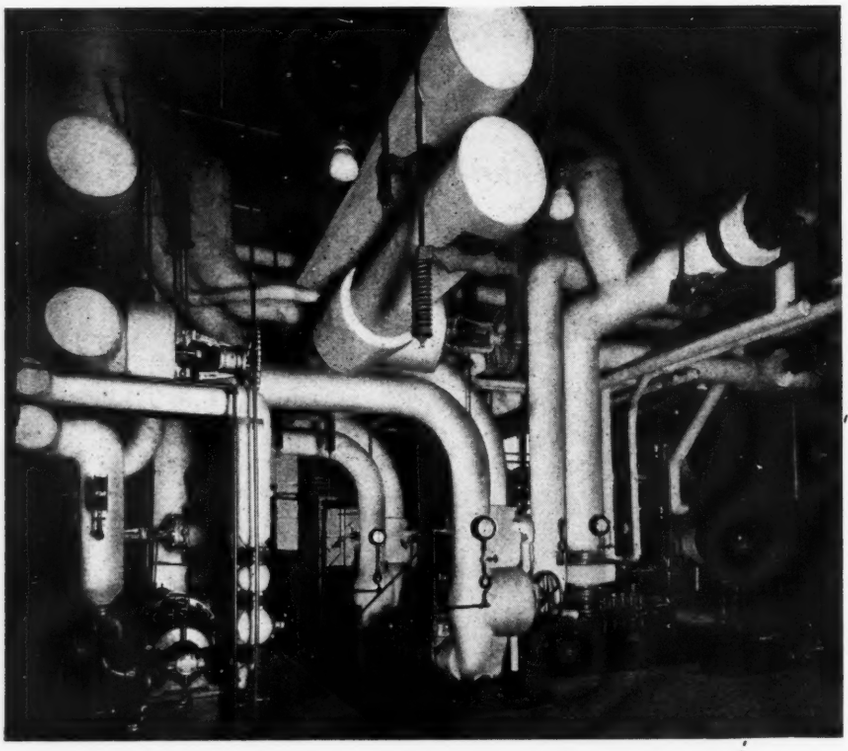
Address_____

City_____ State_____

P.R.

A LUBRICANT FOR EVERY INDUSTRIAL NEED

INSULATION THAT INVITES COMPARISON: unibestos



The best way to satisfy your thinking about insulation is to do as other leading industrials throughout the country have done—conduct tests in your own plant. If the tests run true to form here's what you'll find:

unibestos will conserve B. T. U. s

unibestos will be easier to apply

unibestos will not soften, shatter or shake down

Unibestos is the half-section insulation—is easily and quickly applied. Half-section construction is available in sizes up to 36", thicknesses up to 5". Saws or cuts clean and sharp with ordinary tools—easy to strip off layers to fit unions, flanges, etc. Available in Standard or Super material, or any combination of the two in single layer construction for any intermediate temperature. Write for new bulletin "They'll Specify Unibestos" for tables of list prices, sizes, etc.

UNION ASBESTOS & UNARCO RUBBER CO. FACTORY & GENERAL OFFICE: 1821 S. 54th AVE., CICERO, ILLINOIS
New York: 420 Lexington Av. San Francisco: 116 New Montgomery St.

Helping to CREATE CAPACITY for GREATER PRODUCTION by Eliminating WASTE

★ CORRECT FUEL FEED
You Save COAL, OIL OR GAS

★ PROPER AIR SUPPLY
YOU BURN FUEL *Economically*

★ CONSTANT OVER-FIRE DRAFT
You Prevent UNDUE STACK LOSS

FURNACE DRAFT CONTROLLER
This CASH STANDARD Furnace Draft Controller (which comes complete with Operating Power Cylinder) works from overfire draft, regulating the boiler uptake damper to maintain a constant draft in the combustion chamber.

CASH STANDARD

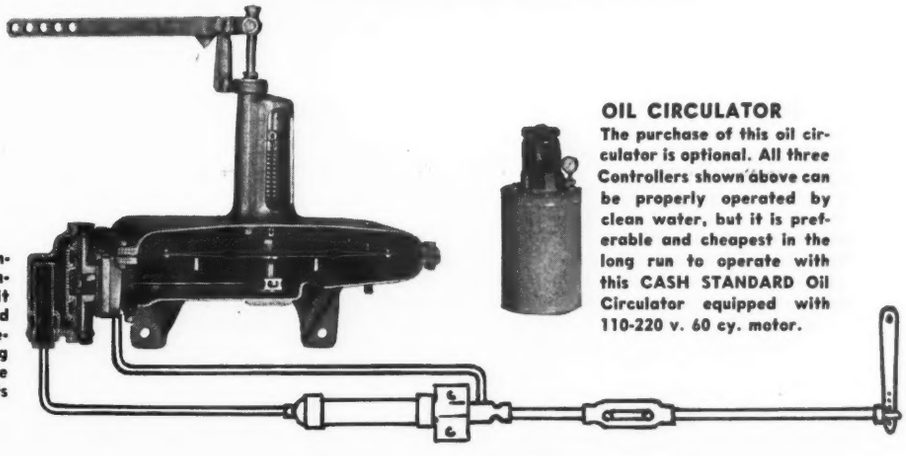
AUTOMATIC COMBUSTION CONTROL SYSTEMS

BOOST YOUR BOILER OUTPUT

• Keeping fuel consumption low is one effective conservation job being done by CASH STANDARD Automatic Combustion Control Systems. Accomplishing this and yet boosting boiler output adds another to the important CASH STANDARD results. The fuel requirements for a given load are reduced because the rate of fuel feed is adjusted exactly to the need — you eliminate fuel waste.

CASH STANDARD units, which make up the systems, are available in a number of variations and can be applied in all plants from the very largest to those as small as 75 boiler horsepower. Bulletin 300 gives full details on application and operation — tells about maintenance savings and why you can hold steam pressure to within very close limits.

FUEL FEED CONTROLLER
This CASH STANDARD Master Controller automatically regulates fuel feed. Locate it conveniently. Working from boiler pressure, it will adjust the rate of combustion by regulating the rate at which fuel (any kind of fuel) is supplied to the boiler furnace. And it will adjust the Air Flow Controller so the correct amount of air is supplied for proper combustion — hence, money saving.



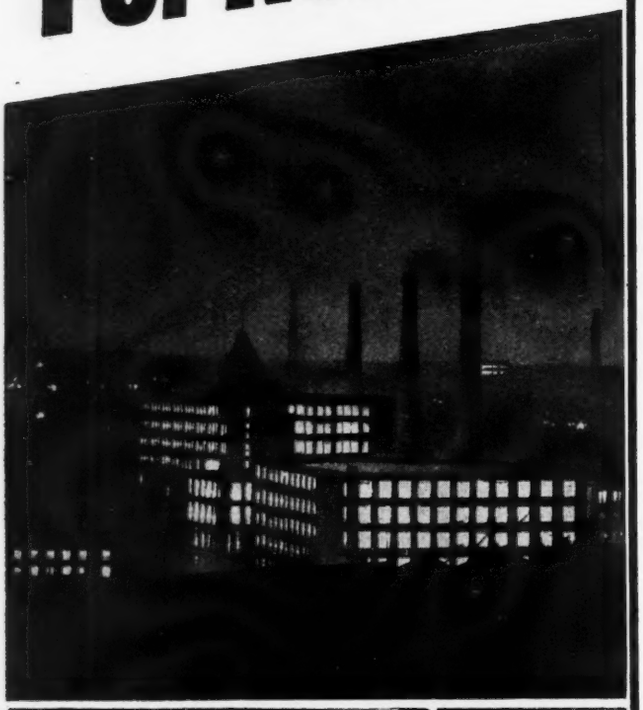
AIR FLOW CONTROLLER
This CASH STANDARD Air Flow Controller meters the air needed for combustion. Install it near its damper. It is not affected by changes in fuel bed resistance or any other variables, because it meters air supply according to the differential pressure through the gas passages of the boiler, doing its part to insure perfect combustion.

OIL CIRCULATOR
The purchase of this oil circulator is optional. All three Controllers shown above can be properly operated by clean water, but it is preferable and cheapest in the long run to operate with this CASH STANDARD Oil Circulator equipped with 110-220 v. 60 cy. motor.

A. W. CASH COMPANY
DECATUR, ILLINOIS

CASH STANDARD
CONTROLS . . VALVES

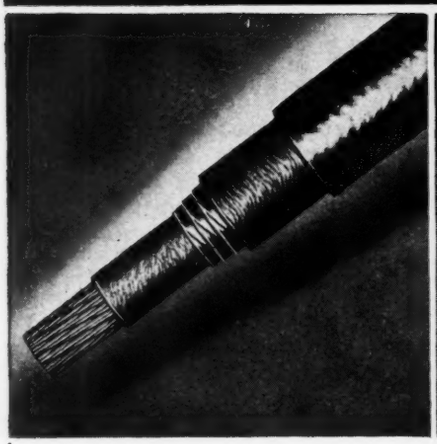
For Non-Stop Production

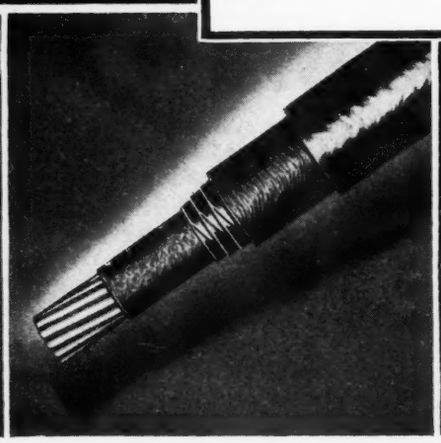


Use Wire that Won't Bake, Burn or Rot

Wire failures that interrupt production occur most frequently in the hot spots —around boilers, furnaces, steam lines, ovens, lehrs, soaking pits or places where heat and moisture, oil, grease and corrosive fumes can't be avoided—and the insulation-destroying conductor heat developed by today's overloads does its share of damage, too.

But steel mills, power plants and many vital industries are maintaining non-stop operating schedules by using *permanently insulated* Rockbestos wires and cables for power, control and lighting circuits, because their insulation is designed for severe service. It won't bake out and crack; won't swell, flow or rot; and won't burn or carry flame.





Rockbestos A. V. C. Motor Lead Cable. For coil connections, motor and transformer leads. Resists heat, flame, moisture, oil and grease. Insulated with felted asbestos, varnished cambric, felted asbestos and asbestos braid. Sizes: No. 18 AWG to 1,000 MCM—600 volt. Underwriters' and Nat. Elec. Code Type AVA, max. operating temp. 110°C. (230°F.).

Rockbestos A. V. C. Power Cable. For power circuits and general hot spot wiring in boiler rooms, steam tunnels, etc. Laminated felted asbestos—varnished cambric insulation and asbestos braid is heat, flame and moisture resistant. 600 to 8000 volt ratings. No. 18 AWG to 1,000 MCM, 600 volt, Underwriters' and Nat. Elec. Code Type AVA, max. operating temp. 110°C. (230°F.).

Rockbestos A. V. C. Boiler Room Wire. For lighting and control circuits exposed to heat, moisture, corrosive fumes, oil, grease and fire hazard. Insulated with varnished cambric, felted asbestos and asbestos braid. Sizes: No. 18 AWG to 4/0—600 volt (No. 6 to 4/0 insulated like power cable). Underwriters' and Nat. Elec. Code Type AVA, max. operating temp. 110°C. (230°F.).

Deliveries: Priority preference ratings control deliveries. Specify minimum footage requirements when ordering and send in preference rating papers. Samples and catalog on request.
Rockbestos Products Corporation
847 Nicoll St., New Haven, Conn.

ROCKBESTOS A.V.C.

PERMANENTLY INSULATED ROCKBESTOS WIRES AND CABLES

The Wire with Permanent Insulation

New York • Buffalo • Cleveland • Chicago • Pittsburgh • St. Louis • Los Angeles • San Francisco • Seattle • Portland, Ore.

THE WOOL IN EAGLE BLANKETS HAS VITAL EXTRA EFFICIENCY!

Physically and chemically stable mineral wool does not deteriorate . . . retains effectiveness at temperatures as high as 1200° F.

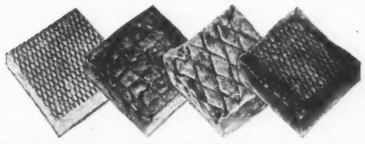
The unique properties of Eagle High Temperature Insulating Wool give extraordinarily low thermal conductivity to Eagle Insulating Blankets.

And because Eagle Insulating Wool is fire-resistant, water-repellent and non-disintegrating, the fuel conservation and production efficiencies which Eagle Blankets make possible, are maintained year after year.

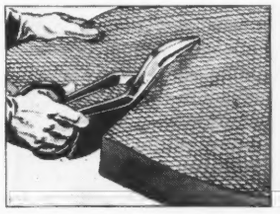
Harsh service conditions and continuous temperatures as high as 1200° F. do not damage Eagle Blankets . . . do not break down their effectiveness.

Application is fast and easy. Blankets are carefully felted and secured between layers of metal fabrics. Fabricated in large sections, 2′ x 4′ and 2′ x 8′. Edges can be laced firmly together to form a tight, unbroken layer that is free from cracks and loose joints. Quickly cut on the job with tin shears to fit irregular areas or around obstructions.

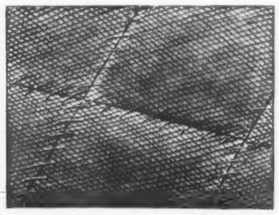
Write today for catalog sheets giving full technical data and application techniques for Eagle High Temperature Insulating Blankets.



Made in both stiff and flexible forms. To meet various requirements, Eagle Blankets are made in several styles—both rigid and semi-rigid. Metal fabrics include wire mesh, expanded lath, stucco lath and rib lath.



Easily cut. Metal fabrics used in Eagle Blankets are strong and sturdy, but are readily cut on the job with sheet metal shears.



Continuous protection. When adjacent edges are properly laced together, all joints are tightly sealed, assuring full protection against heat loss.

Eagle-Picher High Temperature Insulations

Eagle Super "66" Plastic Insulation
Eagle Supertemp Blocks
Eagle L-T Felts
Eagle Blankets

EAGLE EP PICHER

Eagle Finishing Cements
Eagle Loose Wool
Eagle Insulseal
Eagle Insul-stic

THE EAGLE-PICHER LEAD COMPANY · CINCINNATI, OHIO

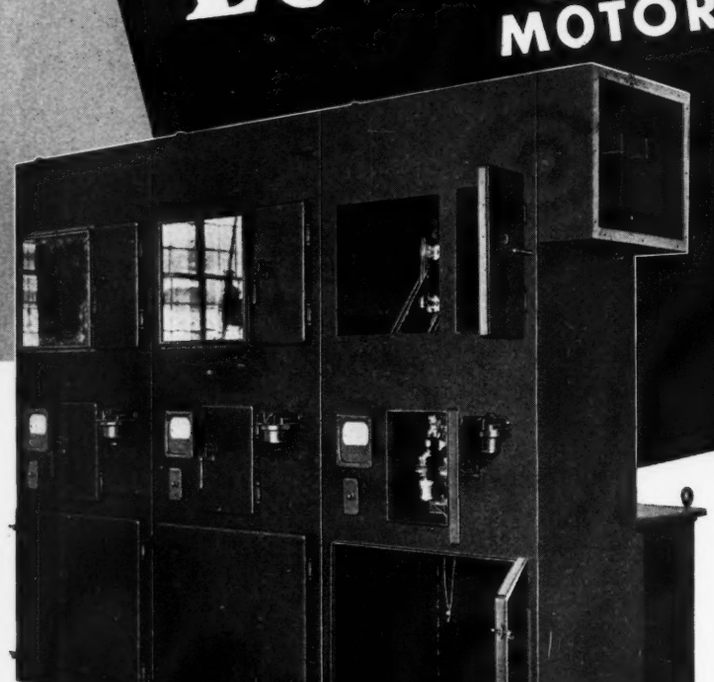
EC&M Steel-clad MOTOR CONTROL

★

SAFE for Operators

★

SAFETY for Equipment, too



● *At the left:* Control units for 3-500 HP, 2300 Volt Synchronous Starters. EC&M Oil-immersed ZHS Contactors mounted in back.

● *Below:* For 3-100 HP, 2300 Volt Squirrel-cage Motors. EC&M heavy-duty ZHS Contactors in oil tanks at front.

Enclosed for safety, complete in every respect, these EC&M Steel-clad Motor Controls give you a compact, easily installed assembly that is attractive, safe and gives full protection to both men and equipment.

The apparatus for each motor is as complete as you like it: including accurate motor protection by EC&M Type ZM Overload Relays - meters - automatic field-switching mechanism for synchronous motors - disconnect switches - self-contained push buttons - enclosed bus feeding all units - self-contained potheads for quick connection and many other features that make a neat-appearing, safe installation.

Booklet 67 shows many illustrations of EC&M Steel-clad Control for single-motor installations - for group-motor jobs - for adding individual units to existing installations, etc. Write for your copy to-day.

The EC&M Type ZHS Contactors used in these full voltage starting applications are of heavy-duty construction and have high arc-rupturing capacity. They are described in Bulletin 1062.

THE ELECTRIC CONTROLLER & MFG. CO. — CLEVELAND, OHIO

THE ELECTRIC CONTROLLER & MFG. CO.

2698 E. 79th Street — **Cleveland, Ohio**

He's in a tough spot, too...

BUT NEVER TOO TOUGH TO HELP YOU

If you think you're hard hit by shortages of material and equipment, consider your ELECTRUNITE Distributor.

It's his job to stock and deliver the boiler, condenser and heat exchanger tubes you need. He has built a business, invested his money and trained an organization to do it. He has always said "Yes" to your tubing demands. But now, due to the needs of *Production for Victory,* he may have been forced to say, "No, you can't have that many tubes" to some of his best friends.

Yet he knows his customers are depending on him. He feels that he must come through—some way. And when a man with that attitude is plugging for you, results are more likely to follow.

Tough as his position is, he's still getting results in meeting emergencies. He usually can deliver enough tubes of the most popular sizes and gauges from stock to take care of needed repairs. He probably can get you the tubes for a new boiler or an extensive retubing job, if it is for *Production for Victory.* He'll do everything possible to help you maintain the power supply you need today.

See your ELECTRUNITE Distributor *first.* To speed up delivery, always be sure to give him complete details with your order—*including preference rating or extension thereof.* He must have this to replenish his stock. The manufacturer needs it to secure the material from which to fabricate the tubes you will need in the future.

STEEL AND TUBES DIVISION
REPUBLIC STEEL CORPORATION
CLEVELAND • OHIO
Berger Manufacturing Division • Niles Steel Products Division
Union Drawn Steel Division • Culvert Division • Truscon Steel Company

Republic

ELECTRUNITE

Reg. U. S. Pat. Off.

ELECTRIC RESISTANCE WELDED BOILER, CONDENSER AND HEAT EXCHANGER TUBES

REPUBLIC STEEL PRODUCTION FOR VICTORY

COTTRELL PROCESS

of

ELECTRICAL PRECIPITATION

universally recognized as a
standard method of removing

DUST, FLY ASH, FUME, MIST & FOG

***from* GASES**

•

30 years of research development and operating experience by the affiliated Cottrell Companies throughout the world is incorporated in the

COTTRELL INSTALLATIONS

offered to meet the requirements
of any problem by

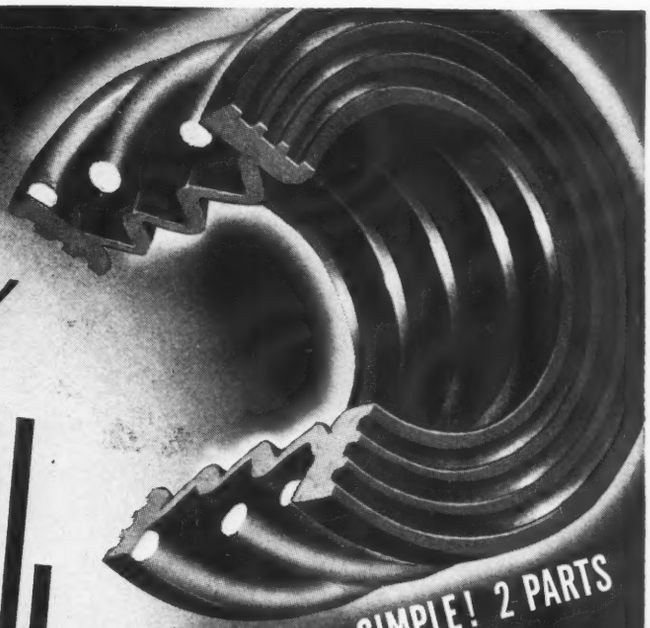
RESEARCH CORPORATION

405 LEXINGTON AVENUE
NEW YORK CITY

59 EAST VAN BUREN STREET
CHICAGO, ILL.

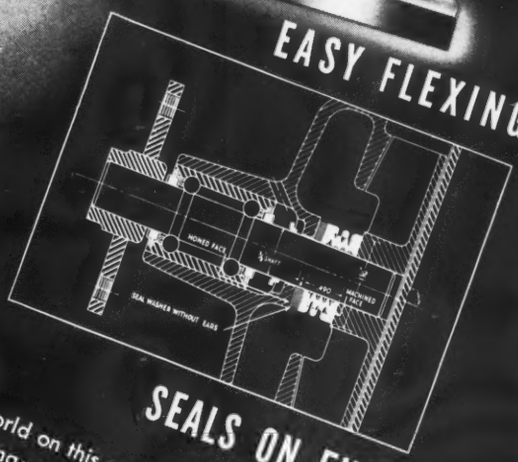
Here's that NEW

PUMP SEAL *by* JOHN CRANE



SIMPLE! 2 PARTS

EASY FLEXING



SEALS ON ENDS

☆

Radical design has focused the attention of pump world on this new seal—a product of 25 years of packing progress . . . Simple! only 2 parts: bellows and spring; radial flexibility; assembled ready for installation . . . Seals on ends, not shaft . . . Impervious to grease, oils, salt water, alcohols and anti-freezes . . . A new water pump seal is news! . . . especially when its revolutionary design cuts across all past ground and streamlines down to 2 parts—when all "dated" concepts such as sealing on the shaft go overboard—when control of every sealing factor is made absolute as in the new John Crane "fluid-tight" Bellows Pump Seal! . . . And the greatest news of all, are the all-time records already established. Pump designers, engineers and manufacturers are invited to submit blueprints. Sketches showing adaptations furnished without obligation . . .

CRANE PACKING COMPANY, 1800 (SAE) CUYLER AVENUE, CHICAGO . . . CRANE PACKING COMPANY, LTD., HAMILTON, ONTARIO, CANADA
Branch offices: Boston, Cleveland, Dallas, Detroit, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, San Francisco, Tulsa.

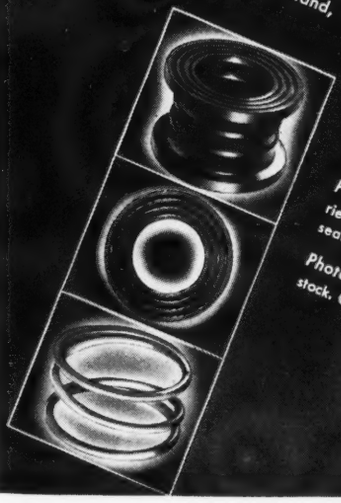


Photo at left, top . . . **BELLOWS** is a series of accordion-like folds, connecting flanged ends. Because of seal's ability to flex and compress as a unit, parallelity of position is maintained. Thus pressure variation, misalignment, fan-thrust, torque or vibration set up by an unbalanced impeller are automatically accommodated. . . . Both bellows and flanged ends are one-piece special, exclusive John Crane synthetic rubber compound.

Photo at left, center . . . **SERRATED CONTACT FACINGS** are a series of concentric grooves and flat-faced ribs on both flanges; they effect seal at the washer and driving-base points.

Photo at left, bottom . . . **SPRING** is tempered, cadmium-plated steel stock. Other corrosion-resistant metals available.

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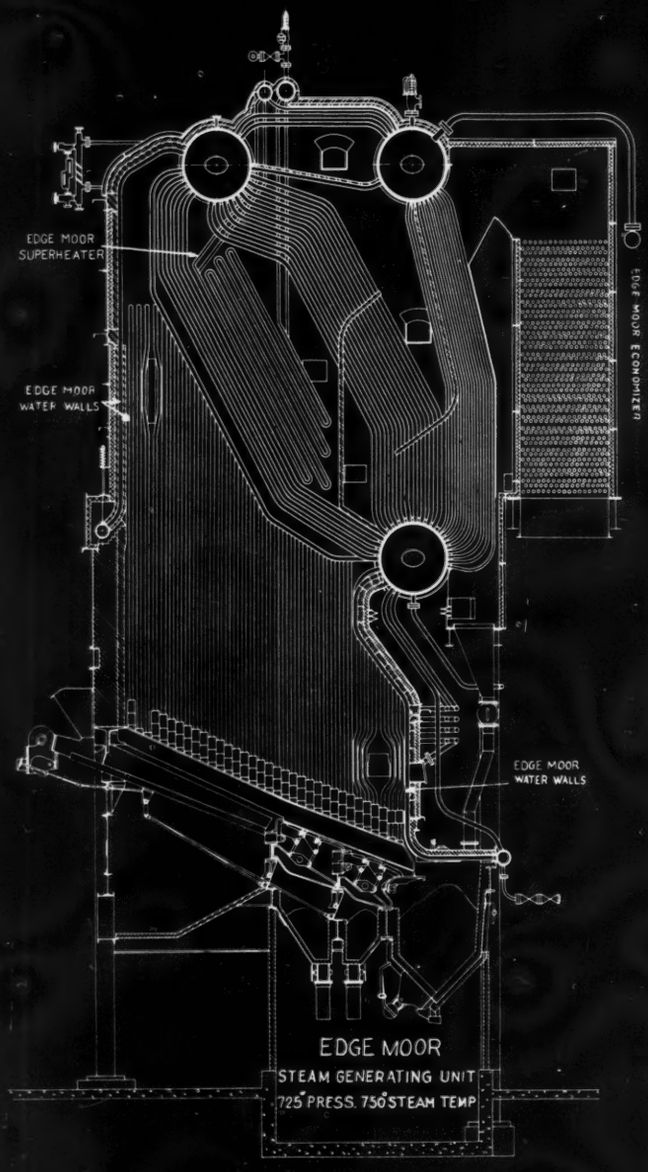

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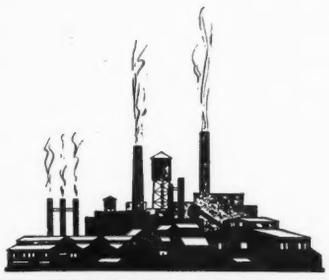

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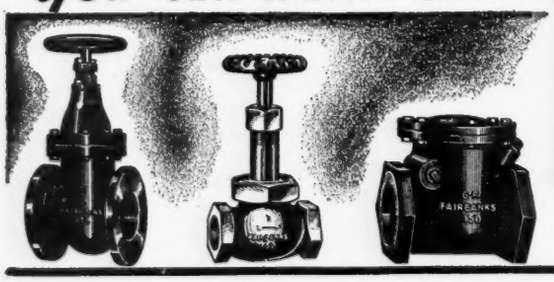

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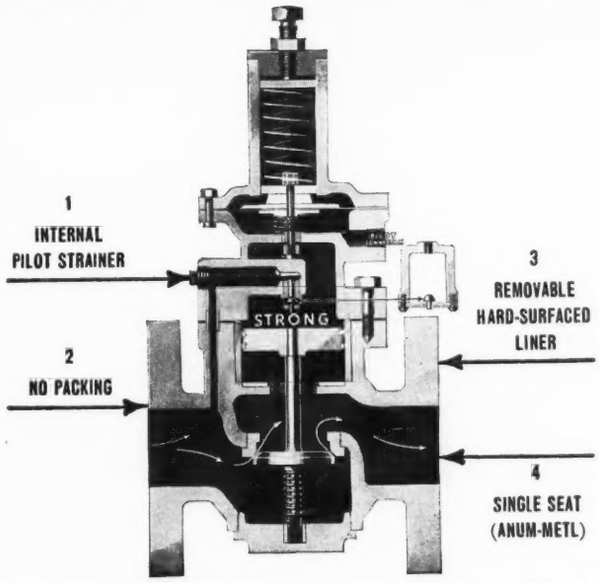

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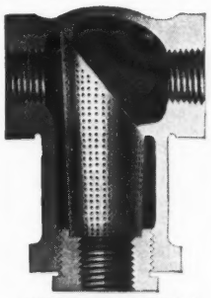

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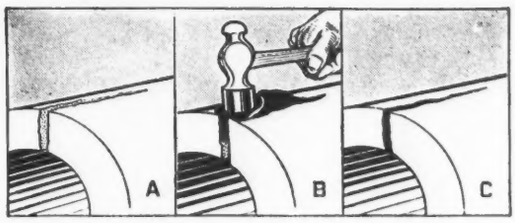

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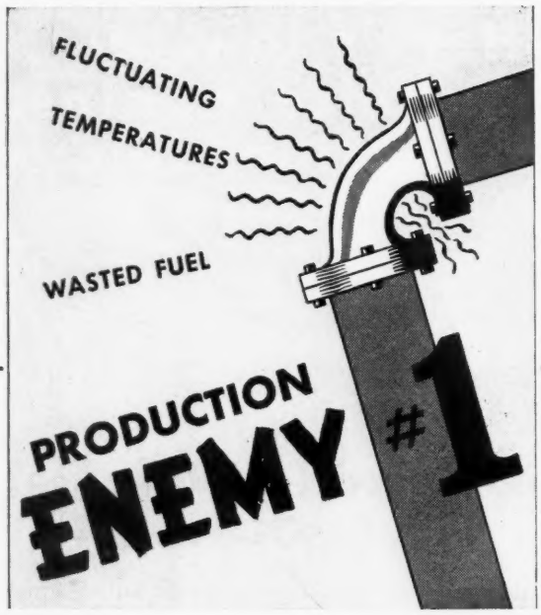

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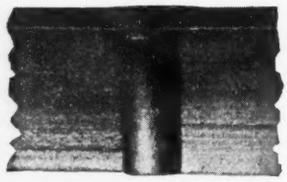

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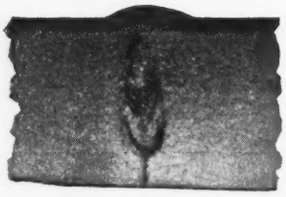

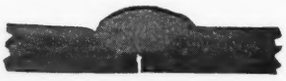

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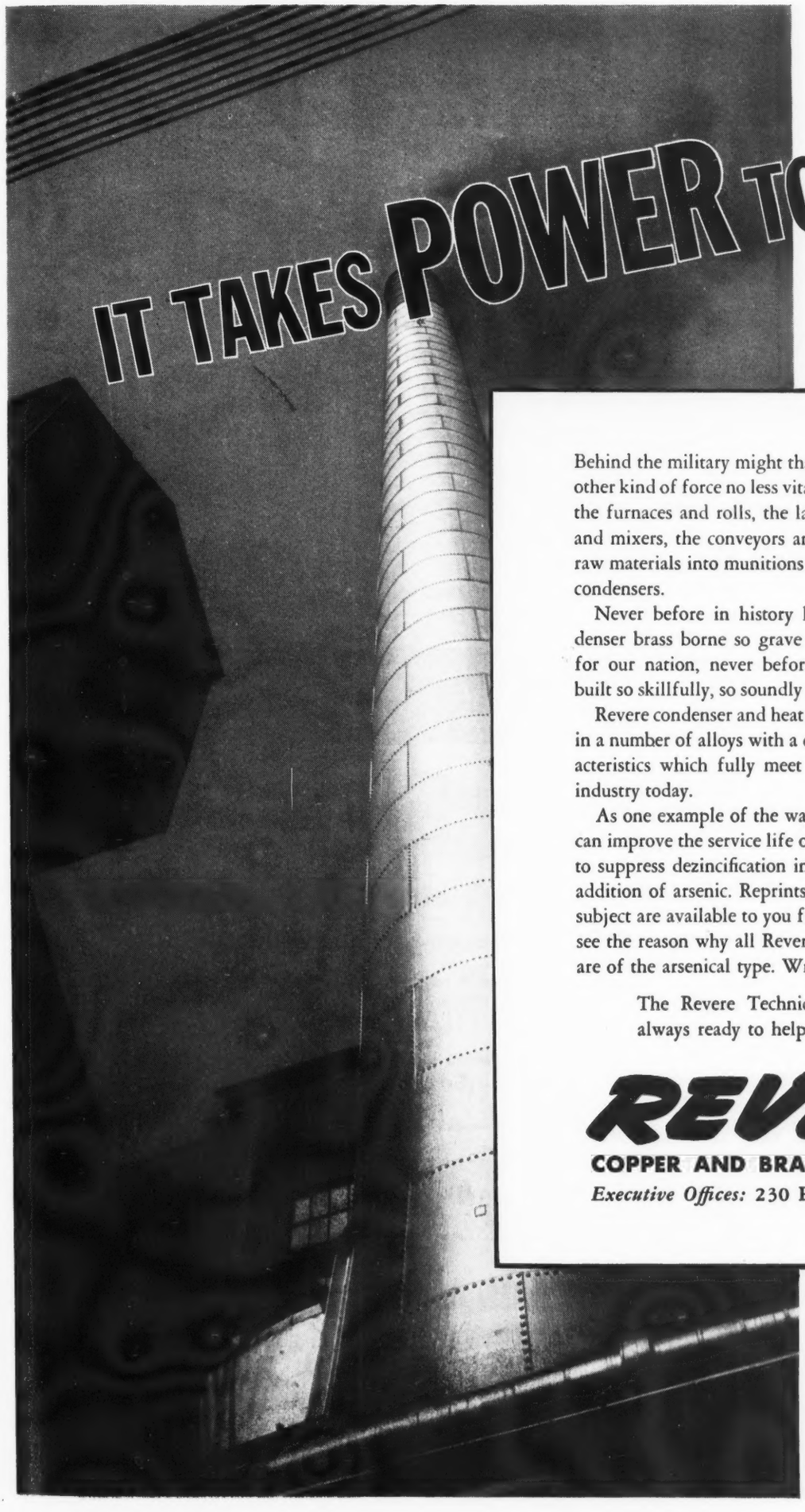

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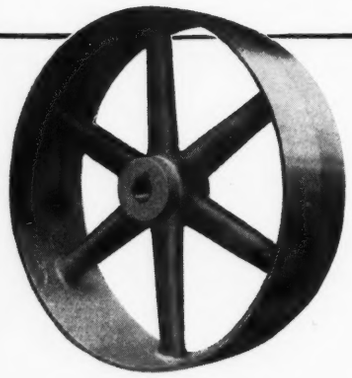

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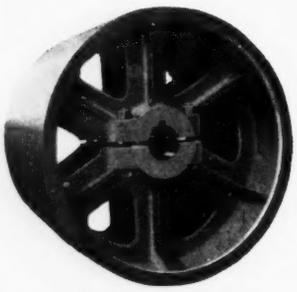

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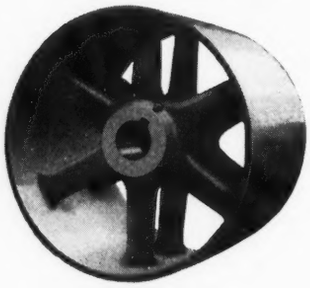

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19

A snail crawls about
1/400 miles per hour

A greyhound runs
35 miles per hour

An eagle flies up to
120 miles per hour

An artillery shell has traveled
3,586 miles per hour

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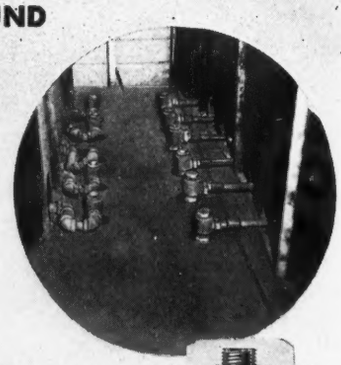
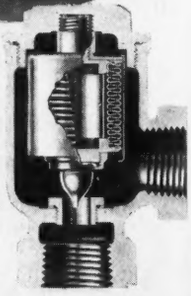


"Trouble-free service for years," says the engineer of this auto wheel company.

And the **SARCO STEAM TRAPS** on this vento stack in the pickling room have to work every minute of the 24 hours or there would be trouble. The men would be driven out of the room by acid fumes if the Sarcos failed.

The engineer of this plant says, "Always use Sarco and you will have no trouble after the installation is completed." That's an idea in these busy times.

Sarco makes all types of steam traps, Thermostatic, Cat. No. 250, Float-Thermostatic, Cat. No. 38, Inverted Bucket, Cat. No. 350.

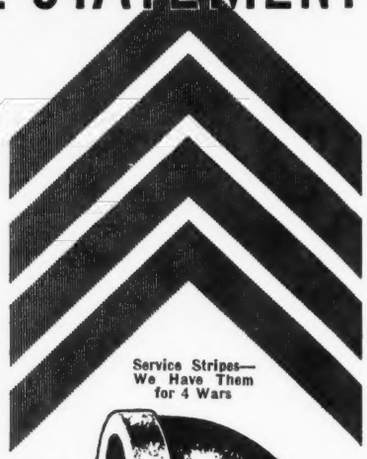


SARCO No. 9

SARCO SAVES STEAM

SARCO COMPANY, INC.
475 Fifth Avenue, New York, N. Y.
SARCO CANADA LTD., TORONTO, ONT.

A SIMPLE STATEMENT OF POLICY



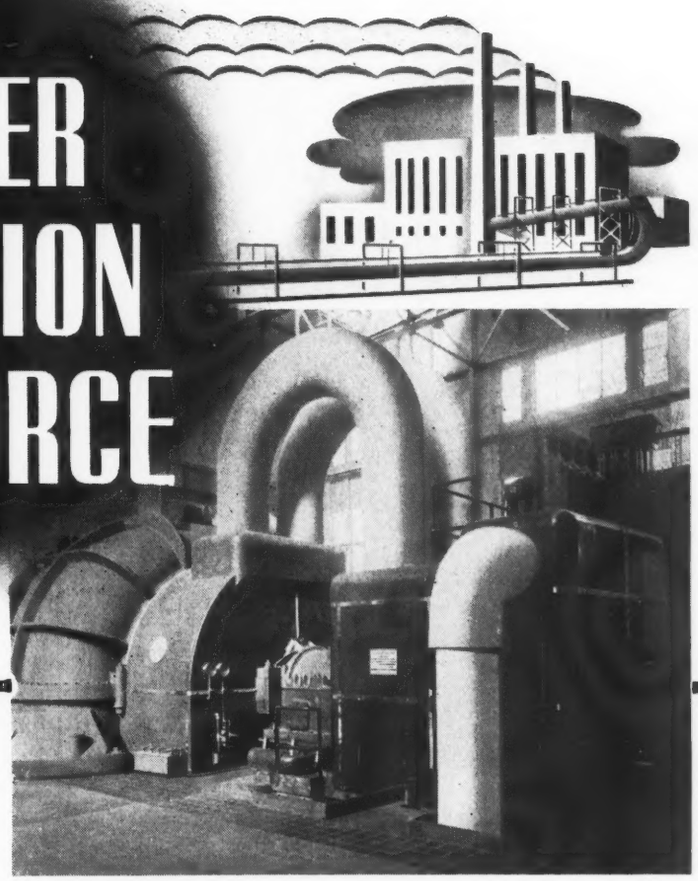
Service Stripes—
We Have Them
for 4 Wars

In the face of a great emergency, Jarecki reiterates a policy that has guided its actions in three previous wars: (1) to regard national needs as a supreme command, and (2) to make a sincere effort, while serving those needs, to meet the demands of its peace-time friends.

JARECKI
VALVES ★ ★ ★ FITTINGS

JARECKI MFG. CO., ERIE, PA. U. S. A.

begin POWER CONSERVATION *at the* SOURCE



To ease the burden imposed by power shortages, the industry must look to greater efficiency from generating units already on the job—which suggests the use of every means to eliminate waste in power production.

Equipment and steam lines that leak heat, also waste fuel and power. With proper application of CAREY Heat Insulations, you can drastically reduce this waste, and at the same time ease the burden on the fuel supply and upon transportation.

The condition of your insulated or inadequately insulated heated surfaces may not permit the savings required by today's standards. In the interest of power and fuel conservation, you should, therefore, make a careful analysis of the condition of your insulation. A Carey representative will be glad to consult with you.

Carey Insulation is one waste-saving improvement that is available at reasonable cost. It is one improvement that returns its cost in savings, usually in a year or less. A nationwide organization is at your command. For details address Dept. 16.

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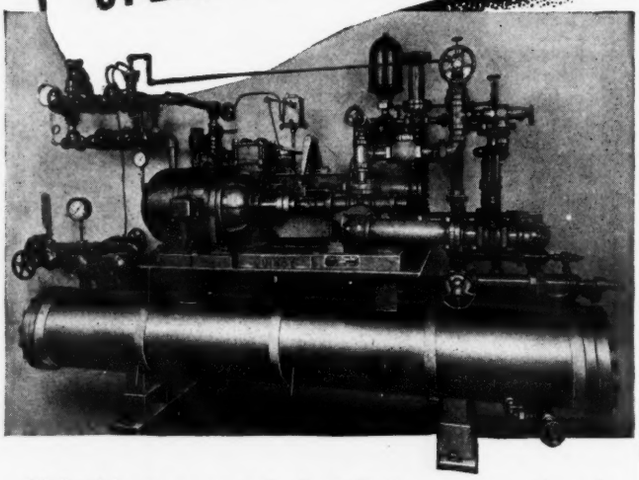
MAGNESIA • ASBESTOS Carey **HEAT INSULATIONS**

This COMPLETE AUTOMATIC UNIT SAVES TIME and INSTALLATION COSTS eliminates OPERATING TROUBLES



Valuable time saved—Installation costs reduced —Operating troubles eliminated . . . That's the story every time an Enco Fuel Oil Pumping and Heating System goes on the firing line.

Planned, built, and tested as a complete automatic unit—an Enco Pumping and Heating Unit needs only to be placed on its foundation and connected to the station piping. Within a few hours it is delivering fuel oil to the burners at the proper temperature and pressure required for efficient combustion—under full automatic control and with complete safety.

Enco Pumping and Heating Units can be built for capacities from 3 up to 100 gallons per minute. Single or duplicate pumps and heaters are used, interconnected so that full capacity may be obtained with either pump and heater. Engineering, material and labor costs for installation are naturally lower than when the work is done in the field.

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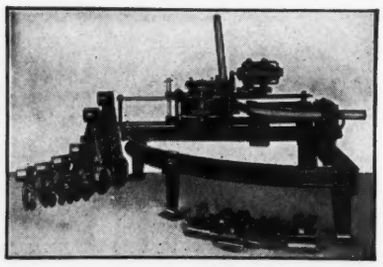
ENCO OIL BURNERS for all grades of OIL-TAR-SLUDGE in sizes with capacity range up to 100,000 lbs. steam per hour

Enco OIL BURNING EQUIPMENT



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The American Cold Pipe, Conduit and Tube Bending Machines

QUICK DELIVERIES . . .

HAND OPERATED TYPES in capacities of 1 in., 2 in., 3 in., and 4 in.

MOTOR OPERATED in three capacities, ½ in. to 4 in., ½ in. to 6 in., and ½ in. to 8 in.

Immediate shipment on hand operated machines; on motor powered from two to four weeks. Wire or air mail letter for printed matter and prices.

Three New Machines: No. 1. For bending extra heavy pipe up to 3". No. 2. For bending all kinds of thin gauge tubing without use of mandrel. No. 3. For bending IPS conduit.

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Are your boilers ready for *Extra Duty?*

Sluggish Boilers
mean less horsepower...less production

All industry operating under war conditions is being asked to work 162 hours a week. Will your boilers continue to deliver under this strain?

Electric Chemical Company offers a comprehensive service in treating aggravated water problems every place . . . whether due to scale, corrosion, color, taste, odor or water softening related to process or boiler feed.

After a survey of water and operating conditions by our trained engineers, we have made recommendations that solved boiler problems under varying conditions throughout the country.

We will be glad to take on your boiler problems. Let's talk it over. Write today . . . especially if your boilers are in line for extra duty.

ELECTRIC CHEMICAL CO.
8001 Franklin Avenue • Cleveland, Ohio

following comparative tests by
National Bureau of Standards

WASHINGTON, D. C. *orders* 22 FOSTER SIRENS

Before placing an order for air raid sirens, the Commissioners of the District of Columbia asked the National Bureau of Standards to conduct comparative tests on the several types of horns and sirens offered for air-raid-warning service.

These tests conclusively proved that the Foster Siren has a higher average decibel rating — a wider range of audibility — than any of the other types tested. As a result of these tests, twenty-two Foster Sirens will be installed in Washington's permanent air-raid-warning system.

Before you purchase sirens, we suggest that you send for details of these tests and their results. A sixteen page booklet containing this information, as well as a descriptive folder on the Foster Siren will be sent without cost or obligation. Simply ask for Reprint MSE and Bulletin 41-S.

This siren not only can be heard for miles, but it needs no pampering. The simple design includes but few parts, and these are constructed to withstand "emergency service."

Furthermore, it works fast — its rising sound pitch or howl reaches its peak in from three to five seconds, depending on the maximum pitch for which this siren is set. And—it can be used for signaling because of its sharp sound cut-off.

If a constant pitch is desired, this siren can be so ordered or factory converted into a revolving cylinder-type of horn which produces practically a single pitch from starting to full speed, as contrasted with the conventional siren action with rising pitch or howl.

Type 30 Foster Siren
(Small Size)

Size of Valve:	1¼ inch (female thread)
Actuating Medium:	Steam or Air
Pressure:	50 lbs. minimum—200 lbs. maximum
Temperature:	450 degs. Fahr. (total)
Consumption:	Steam—approx. 1100 lbs. of steam per hour Air—approx. 500 cu. ft. of free air per minute
Diameter of Rotor:	3 inches
Diameter of Horn:	8½ inches
Net Weight:	60 lbs. (assembled)

Type 45 Foster Siren
(Large Size)

Size of Valve:	1½ inch (female thread)
Actuating Medium:	Steam
Pressure:	75 lbs. minimum—200 lbs. maximum
Temperature:	450 degs. Fahr. (total)
Consumption:	Approx. 3000 lbs. of steam per hour
Diameter of Rotor:	4½ inches
Diameter of Horn:	18 inches
Net Weight:	110 lbs. (assembled)

Both the Type 30 and the Type 45 Foster Siren can be furnished with a solenoid operated valve for electric remote control, either for separate "push button" operation, or tied in as an integral part of an air-raid-warning or fire-alarm system.

FOSTER ENGINEERING Company

PRESSURE REGULATORS... RELIEF AND BACK PRESSURE VALVES... AUTOMATIC STOP AND CHECK VALVES... ALTITUDE VALVES... DAMPER REGULATORS... FAN ENGINE REGULATORS... PUMP GOVERNORS... TEMPERATURE REGULATORS... LIQUID LEVEL CONTROLLERS... FLOAT AND LEVER BALANCED VALVES... NON-RETURN AND TRIPLE DUTY VALVES... VACUUM REGULATORS OR BREAKERS... SIGHT FLOW BOXES... STRAINERS... SAFETY VALVES... SIRENS

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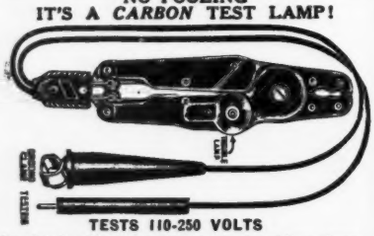
NO FOOLING
IT'S A *CARBON* TEST LAMP!



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Can be obtained from G.E.—Westinghouse, or other first class jobbers.

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Made for all sizes of ammonia, air and gas compressors.

Send for estimates, literature and references.

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VIBRATAP CLEANER

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For free analysis of raw boiler water send jugful of boiler water to SUHM CO., INC., 1942-50 S. Kinnickinnic Ave., Milwaukee, Wisconsin.
Fine Territories Open To Experienced Salesmen

This
WHERE TO BUY
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supplements other advertising in this issue with these additional announcements of products and services essential to modern power plant operation. Make a habit of checking this page, each issue.

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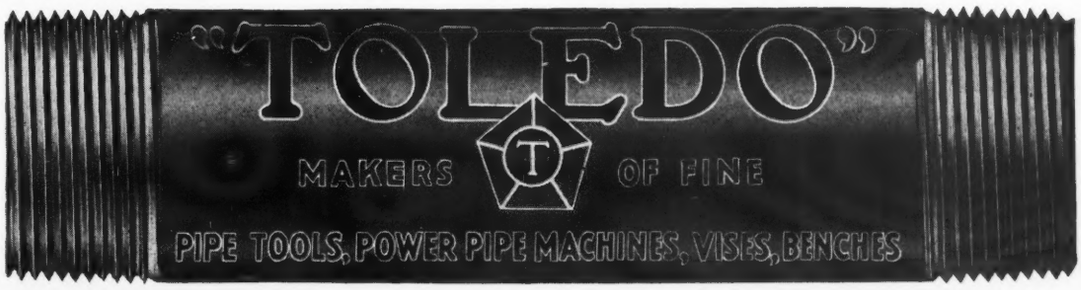
DO NOT THROW AWAY WORN TOOLS OR DULL DIES

It is quite probable these worn tools can be repaired and the dull dies be resharpened to give additional service, conserving steel and other vital materials needed for war production.

WE SHALL WIN THIS WAR BUT TO WIN WE ALL MUST CO-OPERATE TO THE FULLEST EXTENT.

DO YOUR PART. SAVE—SAVE.

THE TOLEDO PIPE THREADING MACHINE CO.
TOLEDO, OHIO ***New York Office, No. 2 Rector St.***



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Removal of two bolts frees the top cap—and the valve and seat are completely exposed to view.

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The accessible Squires has become a byword among power plant operators.

Reliability and economy are among its popular points and besides Squires Traps positively will not wire draw.

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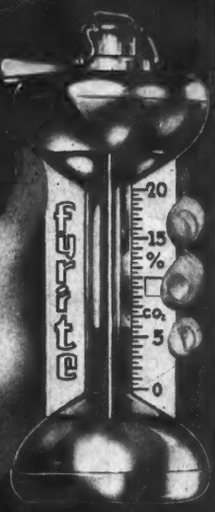
At Last! A SIMPLE ORSAT

for **Accurate CO_2 Analysis**



- **Measures CO_2 within ½ of 1% in 40 seconds.**
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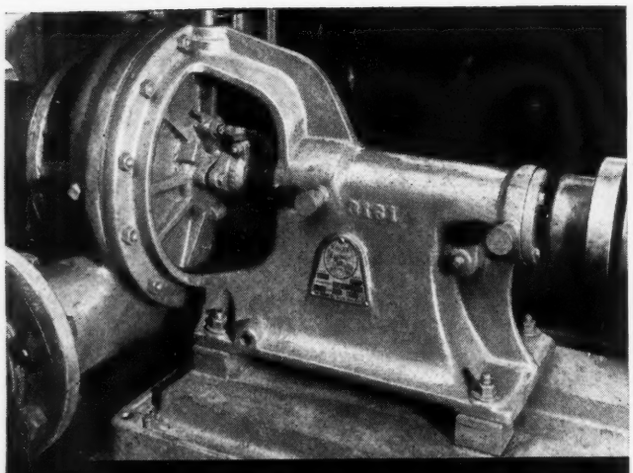

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Three Deming Turbine Pumps perform the vital service of keeping the water level below the finished line of the tunnel.

Accurate estimating on the part of the Deming representative plus dependable performance of Deming Pumps combined to meet the rigid requirements of this important project.

This is merely a "sample" of the kind of cooperation YOU can obtain on YOUR pumping requirements when you depend on Deming for results.

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dependable pumps

Are you equipped to hold your job?—to get a new one?

The men who are keeping their jobs today—who are not feeling the whip of competition—are those who have kept one jump ahead of their jobs. They are the men who are equipped with a thorough-going and growing knowledge of the business they are in.

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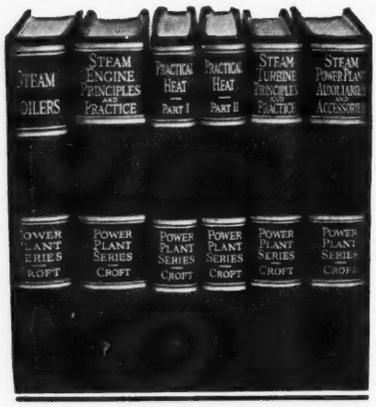
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DEPENDABLE AND QUIET IN OPERATION

QUICKLY AND EASILY INSTALLED

HAVE PRECISELY REGULATED AIR SUPPLY

THE ORIGINAL FORCED DRAFT TURBINE BLOWER

Write for a copy of Bulletin T-98

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A competent power plant operating and maintenance engineer is open for negotiations. Twenty-two years experience in power plant work, both public utility and industrial. Good organizer and personnel handler. Expert at rebuilding old plants. Employed at present but available on short notice. Address

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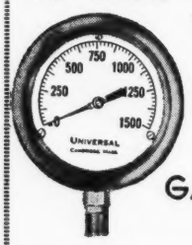

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EQUIPMENT WANTED—PAGE 281

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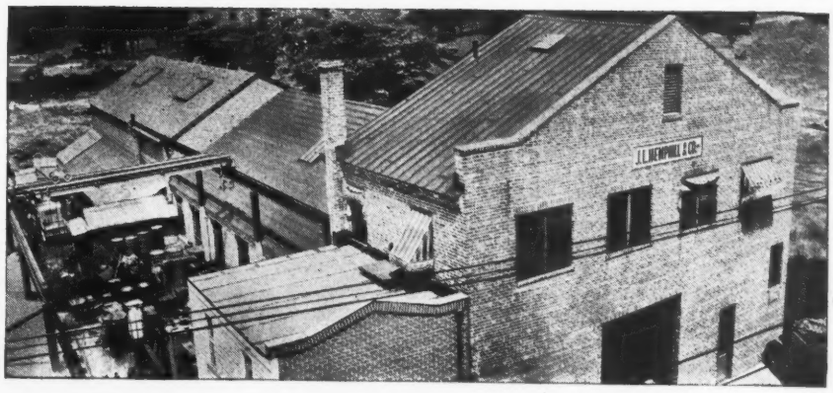

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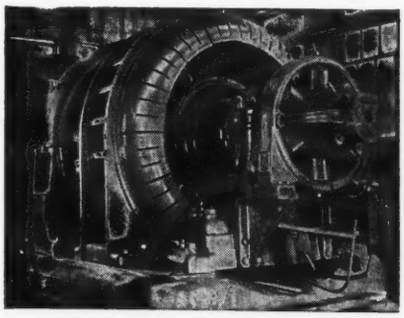


MOTOR GENERATOR SETS

1—500 KW, 125/250 volt, 3-unit, General Elec., synchronous.
1—500 KW, 650 volt, General Electric, syn.
1—300 KW, 250 volt, General Electric, syn.
1—100 KW, 250 volt, synchronous.
1—100 KW, 125 volt, Westinghouse, syn.
1—100 KW, 125/250 volt, Allis Chalmers, squirrel cage.
1—50 KW, 250 volt, General Electric, sq. cg.
1—35 KW, 125 volt, El. Mach., sq. cg.
1—25 KW, 125 volt, General Electric, syn.
1—20 KW, 125 volt, Burke, squirrel cage

D. C. GENERATORS

1—100 KW, 750 RPM, 125 volt, West. Elec.
1—100 KW, 600 RPM, 125/250 volt, G.E.
1—75 KW, 260 RPM, 250 volt, Westinghouse.
1—67½ KW, 700 RPM, 45 volt, Gen. Elec.
2—32 KW, 650 RPM, 125 volt, Westinghouse.

MOTORS—3 PHASE 60 CYCLE

1—720 HP, 360 RPM, 440 volt, G.E., syn.
1—500 HP, 450 RPM, 2200/4000 volt, G.E., slip ring.
1—400 HP, 514 RPM, 440 volt, Westg., sl. rg.
1—350 HP, 300 RPM, 440 volt, G.E., slip ring.
1—350 HP, 100 RPM, 220/440 volt, G.E. syn.
1—335 HP, 600 RPM, 2300 volt, G.E., syn.
1—250 HP, 450 RPM, 220 volt, G.E., slip ring.
1—250 HP, 360 RPM, 440 volt, Westg. sq. cg.
1—250 HP, 514 RPM, 4000 volt, G.E., syn.
1—200 HP, 900 RPM, 440 volt, Westg., sl. rg.
1—200 HP, 600 RPM, 2200 volt, G. E., sl. rg.
1—200 HP, 450 RPM, 2200/4000 v., G.E., sl. rg.
1—200 HP, 514 RPM, 4000 volt, G.E., syn.
1—175 HP, 900 RPM, 440 volt, Westg. syn.
1—150 HP, 1800 RPM, 2300 volt, Allis Chal. sq. cg.
1—150 HP, 900 RPM, 440 volt, Allis Chal. sl. rg.
2—150 HP, 720 RPM, 220 v., Elec. Mach. syn.
1—150 HP, 720 RPM, 440 volt, G.E., slip ring.
1—150 HP, 600 RPM, 440 volt, G.E., slip ring.
1—150 HP, 400 RPM, 440 volt, G.E., sq. cg.
2—125 HP, 720 RPM, 440 volt, G.E., slip ring.
2—125 HP, 450 RPM, 440 volt, G.E., syn.
1—100 HP, 1800 RPM, 440 v., Allis Chal. sq. cg.
1—100 HP, 900 RPM, 220 volt, G.E., sq. cg.
1—100 HP, 900 RPM, 440 volt, G.E., slip ring.
3—100 HP, 720 RPM, 440 volt, G.E., slip ring.
1—100 HP, 720 RPM, 440 volt, G.E., sq. cg.
1—100 HP, 600 RPM, 440 volt, G.E., slip ring.
1—100 HP, 600 RPM, 440 volt, G.E., sq. cg.

MOTORS—3 PHASE 60 CYCLE—(Continued)

1—100 HP, 514 RPM, 440 volt, G.E., sq. cg.
2—100 HP, 450 RPM, 440 volt, G. E., sq. cg.
1—75 HP, 1800 RPM, 220/440 v., G. E., sq. cg.
1—75 HP, 900 RPM, 4000 v., Elec. Mach. syn.
1—75 HP, 900 RPM, 440 volt, G.E., enclosed, fan cooled, squirrel cage.
1—75 HP, 900 RPM, 220 volt, Fairbanks-Morse, slip ring.
1—75 HP, 900 RPM, 2200 volt, G.E., slip ring.
1—75 HP, 514 RPM, 440 volt, G.E., sq. cg.
1—60 HP, 1750 RPM, 220 volt, G.E., sq. cg.

MOTORS—D. C. 230 VOLTS

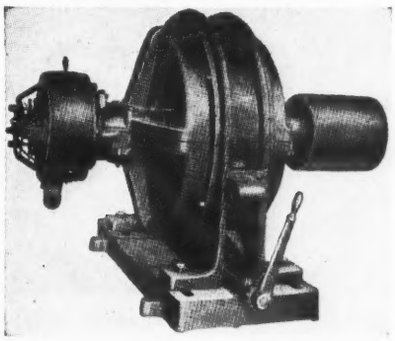
1—125 HP, 850 RPM, G.E., type CD.
1—125 HP, 550 RPM, General Electric.
1—100 HP, 1600 RPM, West., type SK.
1—65 HP, 1000 RPM, G. E., type RC.
1—50 HP, 1750 RPM, Westinghouse, type SK.
1—50 HP, 1100 RPM, Crocker Wheeler.
1—50 HP, 750 RPM, Westinghouse, type SK.
1—50 HP, 700 RPM, Crocker Wheeler.
1—40 HP, 1100 RPM, G.E., type RC.
1—40 HP, 300 RPM, General Electric.
1—30 HP, 750 RPM, G.E., type RC.
1—30 HP, 725 RPM, Westinghouse, type SK.

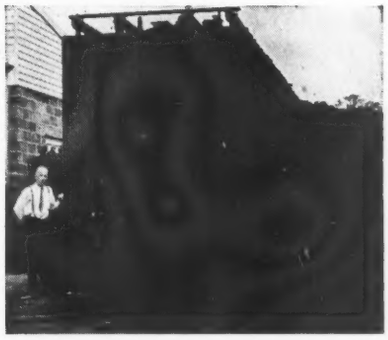
TURBO-GENERATORS

2—1000 KW, 3 ph., 60 cy., 2300/4150 v., cond.
1—625 KVA, Westinghouse, non-condensing.
1—500 KW, G.E., 3 ph., 60 cy., 480 volt, bleeder.
1—375 KVA, Westinghouse, non-condensing.
1—300 KW, G.E., 3 ph., 60 cy., 220 v. cond.
1—200 KW, G.E., 3 ph., 60 cy., 220 volt, cond.
1—150 KW, 125/250 volt, Westg., non-cond.
1—100 KW, 125 volt, Westg., non-cond.
1—25 KW, 125 volt, Ridgeway, non-cond.

MOTORS—VARIABLE SPEED 230 VOLTS

2—100 HP, 475/1375 RPM, Electro Dynamic
1—90 HP, 470/940 RPM, General Electric.
1—75 HP, 525/1575 RPM, Electro Dynamic.
1—75 HP, 235/950 RPM, Burke.
1—60 HP, 600/1200 RPM, General Electric.
1—30 HP, 225/900 RPM, Crocker Wheeler.
1—20 HP, 750/1500 RPM, General Electric.
1—5 HP, 600/1200 RPM, General Electric.
6—5 HP, 400/1200 RPM, Westinghouse.
1—5 HP, 225/900 RPM, Electro Dynamic.
1—5 HP, 600/1800 RPM, General Electric.





15,000 KVA Allis Chalmers, 3 phase 27,000 to 4000 V.

TRANSFORMERS

1—15,000 KVA, Pitts., 3 ph., 26,000/4150 v.
4—833 KVA, Allis Chal., 25 cy., 13,200/440 v.
3—400 KVA, Moloney, 13,800-220/440 volts.
2—400 KVA, G.E., 4156-240/480 v., Scott taps.
3—300 KVA, Pittsburgh, 7800/440 volts.
3—300 KVA, Pittsburgh, 4600-115/230 volts.
4—200 KVA, Pittsburgh, 7800-110/220 volts.
3—150 KVA, G.E., 33,000-2300/4000 Y.
3—150 KVA, Pittsburgh, 6600/440 volts.
12—150 KVA, G.E., 3 ph., 4150-120/208 v.
3—125 KVA, General Electric, 2300/480.
3—100 KVA, Westinghouse, 13200 250 volts.
3—100 KVA, G.E., 2400-240/480 volts.
3—100 KVA, Wagner, 2300-240/120 volts.
1—75 KVA, Pittsburgh, 7600-110/220 volts.
3—50 KVA, Wagner, 4150-220 volts.
3—50 KVA, Westinghouse, 2200-220/110 volts.
4—50 KVA, Westg., air cooled, 440-220/220-110 v.
3—50 KVA, Westinghouse, 220-110/220 volts.
3—50 KVA, G.E., 2200-110/220 volts.
52—37½ KVA, 2200-220/110 v.
10—25 KVA, Westg., air cooled, 440/220-110 v.
3—25 KVA, Moloney, 2200-220/110 volts.
1—25 KVA, G.E., 220/110-220/110 volts.
2—15 KVA, G.E., 2300-115/230 volts.
1—15 KVA, G.E., 440/110-220 volts.
12—15 KVA, Westg., air cooled, 440/220-220-110 v.
4—10 KVA, G. E., 2300-115/230 volts.
3—7½ KVA, G.E., 440-110/220 volts.

OIL CIRCUIT BREAKERS

2—3000 amp., 15,000 v., 3 pole, G.E., type FK-130.
1—3000 amp., 600 v., 4 pole, G.E., type FK-24.
2—2000 amp., 15,000 v., 3 pole, G.E., type FK-53b.
1—1600 amp., 7500 v., 4 pole, Westg., B-2.
1—1500 amp., 440 v., 3 pole, Condit, D12.
1—1200 amp., 15000 v., 4 pole, Westg., B-2.
Also complete stock of small sizes.

ALTERNATORS

1—625 KVA, 450 RPM, 600 volt, Westg.
1—625 KVA, 3600 RPM, 600 volt, G.E.
1—400 KVA, 400 RPM, 240 volt, Westg.
1—375 KVA, 240 RPM, 2300 volt, Westg.
1—375 KVA, 200 RPM, 240 volt, Elec. Mach.
1—250 KVA, 720 RPM, 230 volt, G.E.
1—200 KVA, 3600 RPM, 240 volt, Allis Chal.
1—100 KVA, 1200 RPM, 440 volt, G.E.
1—37½ KVA, 1200 RPM, 2400 volt, Westg.
1—15 KVA, 1800 RPM, 120 volts, G.E.

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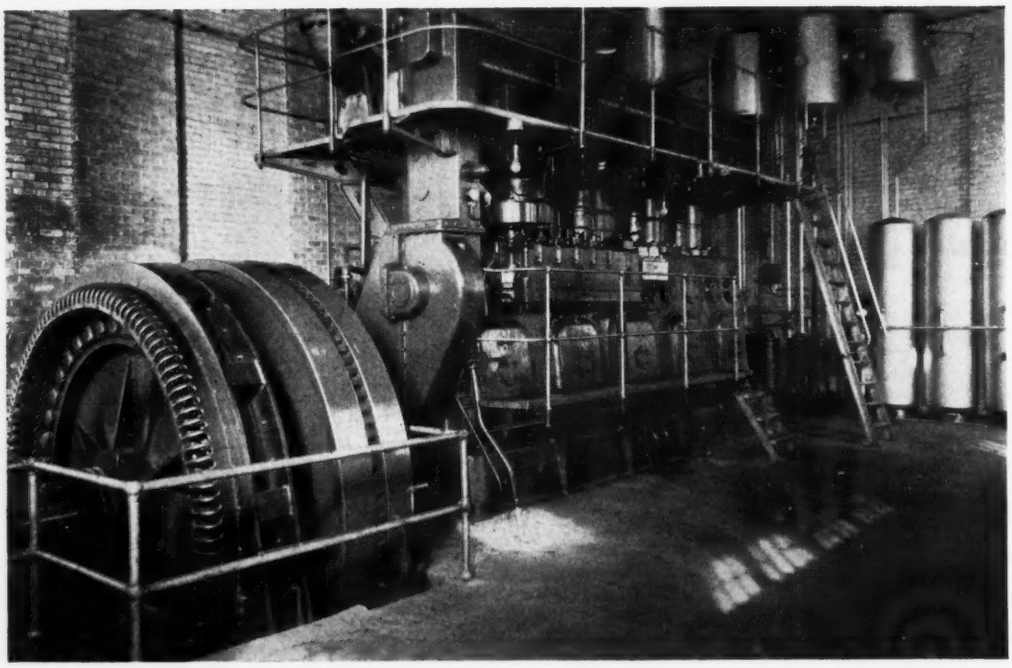
ELECTRICAL POWER



Actual Photograph

800 KVA WESTINGHOUSE-DE LA VERGNE FULL DIESEL OIL ENGINE UNIT

800 KVA WESTINGHOUSE alternating current generator type ES 3 phase 60 cycle 600/2300 volts 180 RPM direct connected to 940 HP De La Vergne full diesel oil engine type I model VB 5 cylinder 180 RPM.

The above unit is complete with all accessories as in operation. Installed new 1932.

ALTERNATING CURRENT ENGINE GENERATORS

3 Phase 60 Cycle

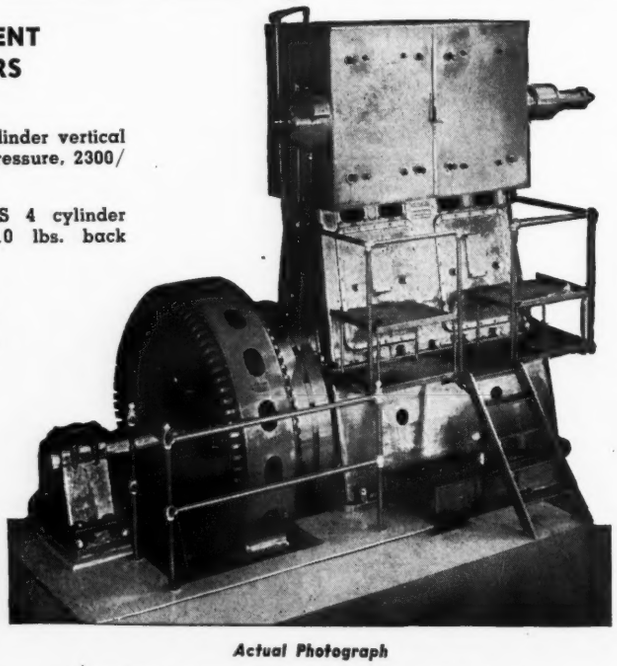
625 KVA WESTINGHOUSE-AMES 4 cylinder vertical uniflow, 150-175 lbs. 0-5 lbs. back pressure, 2300/600/480/240 volts

500 KVA GENERAL ELECTRIC-AMES 4 cylinder vertical uniflow, 150-175 lbs., 0-10 lbs. back pressure, 2300/600/480/240 volts

438 KVA GENERAL ELECTRIC-SKINNER Uniflow, 150-175 lbs., 0-5 lbs. back pressure, 2300/600/480/240 volts

210 KVA GENERAL ELECTRIC-AMES Uniflow, 125-150 lbs., 0-5 lbs. back pressure, 2300/600/480/240 volts

210 KVA GENERAL ELECTRIC-SKINNER Uniflow, 125-150 lbs., 0-5 lbs. back pressure, 2300/600/480/240 volts



Actual Photograph

500 KVA AMES VERTICAL UNIFLOW UNIT

ALTERNATING CURRENT TURBO GENERATORS

3 Phase 60 Cycle

2500 KVA ALLIS CHALMERS condensing 150-200 lbs. pressure 100 deg. superheat with jet condenser; 480 volts

1250 KVA ALLIS CHALMERS condensing 150-200 lbs. pressure 100 deg. superheat with jet condenser; 2300 volts

375 KVA GENERAL ELECTRIC non-condensing, 150 lbs. pressure 7# pressure; 550 volts.

DIRECT CURRENT ENGINE GENERATORS

125/250 Volts 3-Wire

150 KW CROCKER WHEELER-AMES 3 cylinder vertical Uniflow, 200-250 lbs., 0-8 lbs. back pressure

125 KW CROCKER WHEELER-AMES 3 cylinder vertical Uniflow, 200-250 lbs., 0-8 lbs. back pressure.

THE NATIONAL POWER

ER EQUIPMENT

ROTARY CONVERTER

60 Cycle

3500 KW (2) WESTINGHOUSE, 225-285 volts D.C., 225 RPM with 3 phase 60 cycle 13200 volt transformers

2500 KW WESTINGHOUSE, 600 volts D.C., 400 RPM with 3 phase 60 cycle 11000 volt transformers

1500 KW WESTINGHOUSE, 225-285 volts D.C., 450 RPM with 3 phase 60 cycle 2300/4000-6900/12000 volt transformers

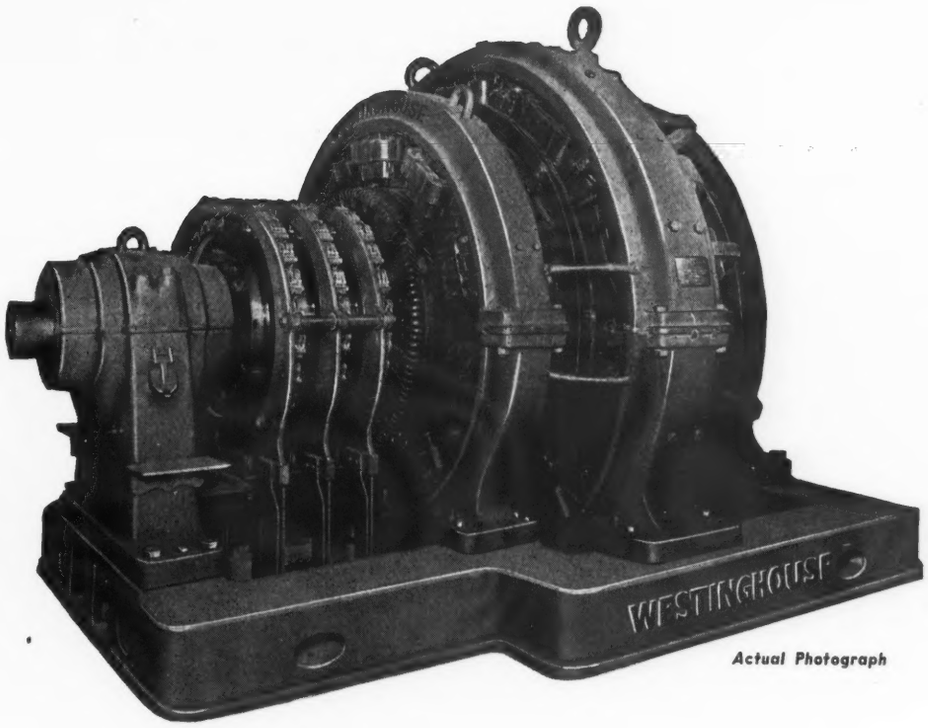
750 KW GENERAL ELECTRIC, 600 volts D.C., 1200 RPM with 3 phase 60 cycle 2300/4000 volt transformers

300 KW WESTINGHOUSE, 600 volts D.C., 1200 RPM with 3 phase 60 cycle 13200 volt transformers

ROTARY CONVERTERS

25 Cycle

1500 KW WESTINGHOUSE, 600 volts D.C., 500 RPM with 3 phase 25 cycle 11000 volt transformer



Actual Photograph

1500 KW WESTINGHOUSE ROTARY CONVERTER

1500 KW WESTINGHOUSE interpole rotary converter, 270 volts DC 450 RPM; 6 phase 60 cycle A.C. with single phase 2300/4000-6900/12000 volt transformers. Complete with control.

MOTOR GENERATOR SETS

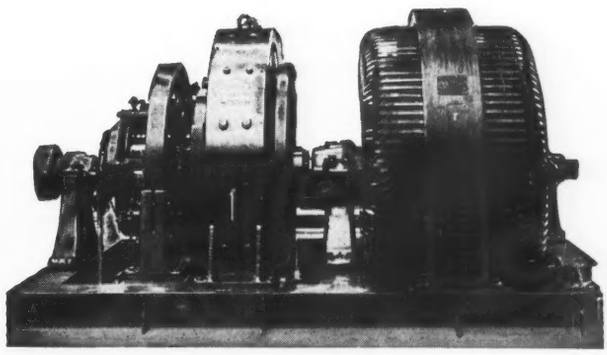
3 Phase 60 Cycle

1000 KW GENERAL ELECTRIC synchronous, 125-250 volts 3-wire D.C.; 3 phase 60 cycle 13200 volts A.C., 720 RPM

750 KW GENERAL ELECTRIC synchronous, 600 volts D.C., 3 phase 60 cycle 2300 volts A.C., 720 RPM

300 KW (2) WESTINGHOUSE synchronous, 125 volts D.C., 3 phase 60 cycle 220/440 volts A.C., 1200 RPM

300 KW (2) WESTINGHOUSE induction, 125 volts D.C., 3 phase 60 cycle 220/440 volts A.C., 1200 RPM



Actual Photograph

1000 KW GENERAL ELECTRIC MOTOR GENERATOR SET

1000 KW GENERAL ELECTRIC direct current generator, 125/250 volts 3-wire 720 RPM direct connected to 1400 HP 80% P.F. General Electric synchronous motor 3 phase 60 cycle 13200/6600 volts 720 RPM. Equipped with D.C. breakers.

MACHINERY CO. 1921 SCRANTON RD. CLEVELAND, OHIO

POWER PLANT MACHINERY

Available Immediate Delivery

TURBINE-GENERATOR UNITS

3 phase, 60 cycle

6250 KVA Westinghouse condensing 175-200 lb. pressure, 2300 volts, complete with surface condenser and auxiliaries.

3750 KVA G.E. condensing 200 lb. pressure, 100° superheat, 2300 volts, 1800 RPM, complete with surface condenser.

1563 KVA G.E. condensing 175-200 lb. pressure, 500° T.T., 2300 volts, 3600 RPM, complete with surface condenser and condensing auxiliaries.

1250 KVA ALLIS condensing 150-200 lb. pressure, 100° superheat, 2300 volts, 3600 RPM, complete with Wheeler surface condenser.

937 KVA G.E. condensing 200 lb. pressure, 100° SH, 2300 volts, 3600 RPM complete with Ingersoll-Rand condenser, exciter, switchboard and instruments.

937 KVA Westinghouse automatic extraction condensing, 150-200 lb. pressure, 10 lb. bleeder, 480 volts, 3600 RPM, complete with direct connected exciter and switchboard.

937 KVA ALLIS condensing 200 lb. pressure, 100° SH, 2300-550-480 volts, 3600 RPM complete surface condenser with auxiliaries, direct connected exciter—Modern and practically new.

937 KVA ALLIS condensing 150 to 200 lb. pressure, 475° TT, 2300 volts, 3600 RPM, complete with direct connected exciter, surface condenser and auxiliaries.

750 KVA G.E. condensing, 150-200 lb. pressure, 2300 volts, 3600 RPM, complete surface condenser and exciter set.

625 KVA G.E. condensing 200 lb. pressure, 2300 volts, 3600 RPM, complete with condenser and auxiliaries.

375 KVA G.E. condensing 225 lb. pressure, 150° S.H., 2300 volts, 3600 RPM, complete direct connected exciter, Manistee jet condenser with auxiliaries.

112 KVA Allis-Chalmers non-condensing, 125-150 lb. pressure, 5 lb. back pressure, 480 volts, 3600 RPM, complete direct connected exciter and rheostats.

MOTOR GENERATOR SETS

1500 KW ALLIS 600 volt direct current generator direct connected to a 2190 HP, 3 phase, 60 cycle, 4000 volt, 300 RPM synchronous motor.

750 KW G.E. 550 or 275 volt, direct current generator direct connected 1075 HP 90% P.F., 3 phase, 60 cycle, 4000 volt, 514 RPM synchronous motor.

20 KW G.E. 125 volts direct current generator direct connected 25 HP, 3 phase, 60 cycle, 220 volts, 1200 RPM motor.

ENGINE-GENERATOR UNITS

3 phase, 60 cycle—Alternating Current

1125 KVA G.E. 480 volts, 150 RPM direct connected 24"x46"x33" Erie-Ball cross compound engine, complete exciter, and rheostats.

1000 KVA G.E. 480 volts, 150 RPM direct connected 31"x36" Skinner Unaflow engine, complete exciter, switchboard panel and instruments.

500 KVA G.E., 240/480 volts, 150 RPM direct connected 26"x32" Skinner Universal Unaflow non-condensing engine, 130-160 lb., 6 lb. back pressure, complete exciter and rheostats.

500 KVA G.E. 240 volts, 120 RPM direct connected 20"x42" Rice Sargent Corliss non-condensing engine, 125-150 lb., 10 lb. back pressure.

438 KVA G.E. 240/480 volts, 150 RPM direct connected 24"x30" Chuse N.R.C. non-condensing engine, 125-150 lb. pressure, 5 lb. back pressure.

ENGINE-GENERATOR UNITS

Direct Current

1500 KW WESTINGHOUSE 250 volts, 360 RPM generator direct connected by reduction gear to a Westinghouse condensing turbo generator unit complete with auxiliaries.

500 KW G.E. 250 volts, 150 RPM direct connected 26"x36" Skinner Universal Unaflow non-condensing engine.

300 KW WESTINGHOUSE 250 volts, 175 RPM direct connected 24"x26" Skinner Unaflow non-condensing engine, 110-150 lb. pressure, 5 lb. back pressure, complete switchboard and instruments.

250 KW Westinghouse 1000 amperes, 250 volts, 200 RPM direct connected 23"x 24" Ames Unaflow engine, 125-150 lb. pressure, complete switchboard and instruments.

200 KW G.E., 125 volt, 200 RPM direct connected 18"x24" Erie Ball non-condensing engine, 135-150 lb. pressure.

100 KW GENERAL ELECTRIC, 125 volts, 250 RPM direct connected Skinner Universal Unaflow non-condensing engine, complete switchboard and instruments.

MOTORS

3 phase, 60 cycle

800 HP, WESTGH. 440 V., 240 RPM synchronous.

620 HP G.E. type ATI, form S, 440 volt, 164 RPM synchronous.

400 HP, G.E. type TS, Form AL, 440 V. 300 RPM synchronous.

400 HP, WESTINGHOUSE type CW, 440 V., 500 RPM, slip ring.

300 HP, 80% P.F. WESTINGHOUSE 2300 V., 200 RPM synchronous.

250 HP, ALLIS-CHALMERS 440 V., 600 RPM synchronous.

200 HP, G.E. 2200 volt, 435 RPM slip ring.

125 HP, (3) 80% P.F. Elec. Mchy. 440 V., 400 RPM synchronous with starting equipment.

125 HP, 80% P.F. Elec. Mchy. 440 V., 514 RPM synchronous.

50 HP, type I, form M, 3 phase, 60 cycle, 2200 volts, 1200 RPM slip ring.

50 HP, (2) G.E. form K, 220 V., 900 RPM squirrel cage.

MISCELLANEOUS

1 WESTINGHOUSE frequency changer set consisting of a 655 HP, 3 phase, 25 cycle, 2200 volt, 300 RPM synchronous motor direct connected to 565 KVA 80% P.F., 3 phase, 60 cycle, 240 volt alternating current generator complete and equipped with direct connected exciters, all panels with instruments—practically new.

250 KW CROCKER-WHEELER 250 volt, 600 RPM compound wound interpole direct current generator.

1500 KVA, 3 phase, 60 cycle, 22,000 volt primary, 2300 volt secondary WESTINGHOUSE transformer.

900 KW G.E. 3 phase, 60 cycle, 480 volt, 150 RPM alternating current generator with exciter.

500 KVA IDEAL, 3 phase, 60 cycle, 240 volts, 400 RPM, three-bearing belted type generator with direct connected exciter and rheostats.

312 KVA WESTINGHOUSE, 3 phase, 60 cycle, 2300 or 220 volts, 200 RPM, engine type generator with belt driven exciter and rheostats.

200 KVA WESTINGHOUSE, 3 phase, 60 cycle, 240 volts, 200 RPM engine type generator with rheostat.

1 ELLIOTT EHRHART jet condenser with all auxiliaries suitable for operation with a 5000 KW turbine-generator unit.

1500 sq. ft. WESTINGHOUSE surface condenser.

1055 cubic feet, 100 lb. air pressure CHICAGO PNEUMATIC horizontal compressor direct connected to 170 HP, 240 V., 150 RPM General Electric direct current motor.

SPECIAL

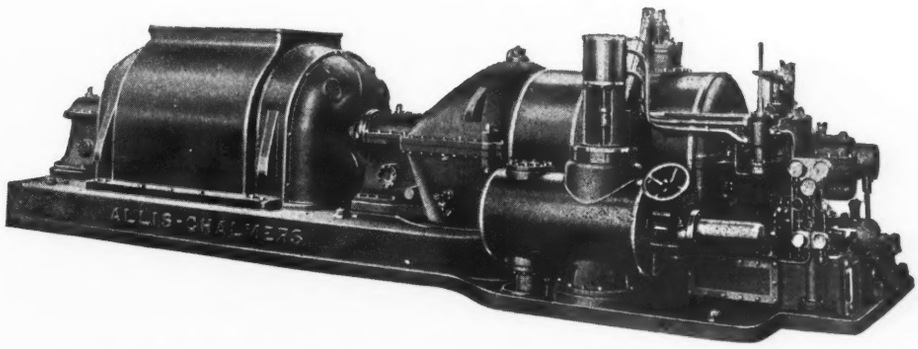
850 KVA (2) G.E. 3 phase, 60 cycle, 2300 volt alternating current generators each direct connected to a 1250 HP Nordberg vertical full Diesel engine complete with all auxiliaries—exact duplicates.

Utilities Electrical Machinery Corporation
600 NATIONAL CITY BANK BLDG. CLEVELAND, OHIO
WIRE OR PHONE LONG DISTANCE 422

DEPENDABLE

Turbo-Generators

It is the Practice of this Company to Confine its Inventory Strictly to Comparatively Modern, Little Used Turbines Some Are Practically New



2—Allis-Chalmers, 2500-KVA, 3/60/2300-volt, 200#-P, 500°F-TT, Surface Condensers

PART OF OUR INVENTORY—BELOW

1—G.E., 7500-KVA, 3/60/600-2300-v, 250# 575° Maximum. Surface Condenser.

1—Allis-Chalmers 4000-KVA, 3/60/2300-v, 200#, 500°-F, TT, Condensing.

1—G.E., 1875-KVA, 3/60/480-v, 200#, 500°, Condensing.

1—G.E., 1563-KVA, 3/60/2300-v, 175#, 100° SH, 28". Surface Condenser.

1—Westinghouse, 1563 KVA, 3/60/2400 volts, 200#, 100° SH. Condensing, Modern.

1—Westinghouse 1000-KW, 250-volt, Direct Current, Condensing, 150/200# pressure. Surface Condenser.

1—Allis-Chalmers 1250-KVA, 3/60/2300-v, 200#, 500° TT. Surface Condenser.

1—G.E., 1250-KVA, 3/60/480-v, 175#-P and 16# Abso. Mixed Pressure.

1—G.E., 937-KVA, 3/60/2300-v, 200#, 500°-TT, 3-Stage Condensing.

1—Allis-Chalmers, 937-KVA, 3/60/2300-v, 200#, 500°-TT, Condensing Surface Condenser.

1—G.E., 625-KVA, 3/60/2300-v, 200#, 500°TT. Condensing.

1—G.E., 625-KVA, 3/60/600-v, 250#, 550°F-TT, Condensing Modern.

WILMS, WEAVER & CO. Union Guardian Bldg. DETROIT, MICH.

We Deal in Turbo-Generators Exclusively

GUARANTEED REBUILT POWER EQUIPMENT

. . . BUILT TO MEET TOUGH PRODUCTION SCHEDULES

SLIPRING MOTORS

HP	Make	Type	Volts	Speed
2850	Wtg.	CW	6600	450
1500	Allis. Chal.	ANY	2200	485
800	Wtg.	CW	6600	443
600	G.E. (2)	IM	2300	1770
500	G.E. (2)	IM	2200	600
350	G.E.	IM	2200	360
350	G.E.	MT	2300	300
300	Allis Chal.	[illegible]	2300	300
300	G.E.	MT	2200	514
200	G.E.	MT	440	870
200	G.E. (2)	IL	440	600
225	G.E.	IM	440	600
200	Howell R. brg.		440	600
200	G.E.	IM	2200	600
200	Wtg.	CW	440	580
200	Wtg.	CW	440	345
150	Wagner	BR	440	1150
150	Al. Ch.	ANY	440	870
150	G.E.	MT	440	870
150	G.E.	IM	220	600
150	G.E.	IM	220	585
100	Wtg.	HP	440	230
125	G.E.	MT	440	720
75	Al. Chal.		2200	720
75	G.E.	MT	440	850
75	Allis Chal.	ARY	220	865

SQUIRREL CAGE

200	G.E.	KTP557	2200	1800
200	G.E.	IK	440	580
200	Wtg.	CS	440	580
200	Wtg.	CS	440	580
150	G.E.	IK	2200	1750
150	Wtg.	CS	2300	1175
150	Al. Ch.		440	1170
125	G.E.	KT	220	1800
125	G.E.	IK	2200	580
100	Wtg. (2)	CS	440	1160
100	Wtg.	CS	2200	1160
100	G.E.	IK	220	1200
100	G.E.	IK	440	900
75	G.E.	IK	2200	1700
75	G.E.	KT	2200	1200
100	Wagner	38T3BM	2200	428
75	G.E. (5)	IK	220	600
60	Allis Chal.	AR	440	3500
60	Wagner	VRB	220	1200
60	G.E.	IK	220	900
60	G.E.	IK	220	900
60	Wtg.	CS	220	435
50	Howell	FBB	220	1725
50	Watson	KH	440	1720
50	G.E. (2)	KT	2200	870
50	G.E.	IK	440	490

MOTOR-GENERATOR SETS

1000 KW GE 275 v DC 6600 syn AC
500 KW GE 600 v DC 4400/2200 syn.
300 KW GE 3-unit 3-w 2200 v syn AC
300 KW GE 600 v DC 11000/2200 AC
225 KW Ideal 115 v DC 2200 v AC syn.
225 KW Wtg 115 v DC 2200 v AC syn.
150 KW GE 250 v DC 2200/220 syn.
150 KW GE 600 v DC 4000/2300 syn.
150 KW GE 250 v DC 2200/440 syn.
100 KW AC 125 v DC 440 v ind AC
100 KW Wtg 125 v DC 440 v ind AC
100 KW GE 230 v DC 440 v syn AC
100 KW GE 250 v DC 2200 v ind AC
90 KW GE 250 v DC 220 ind AC
75 KW GE 125 v DC 220 syn AC
75 KW GE 125 v DC 220/440 ind AC
75 KW GE 125 v DC 220 v AC ind.
90 HP Wtg. 110 v DC 2200 AC gen
50 KW AC 125 v DC 2200 v ind AC
60 KW GE 125 v DC 4000/2200 ind AC
60 KW Wtg 3-3 DC (2) 220 v ind AC
50 KW AC 125 v DC ind AC
33 KW Diehl 110 v DC 220 syn AC

SYNCHRONOUS

HP	Make	Type	Volts	Speed
1050	GE	ATI	460	900
875	Wtg		440	240
800	Al. Ch.		2300	180
750	Wtg. (2)		4000/2300	1200
650	Al. Ch.		2300	1200
450	Wtg. (2)		4000/2300	1200
400	GE	TRB	440/2300	360
225	GE	ATI	240	720
200	Wtg.	HR	2200	225
200	Elec. Mhy		2200	1200
190	Elec. Mhy (2)		440	720
190	Elec. Mhy (2)		220	514
75	Elec. Mhy		229	1200

AC GENERATORS

KVA	Make	Type	Volts	Speed
187	GE	ATB	2300	600
175	Wtg.		2200	900
150	West Elec S15C		230	900
125	Wtg.		2400	900
25	Cr. Wh.		240	1800
10	Cr. Wh.		240	1800
4	GE	1 ph 14½ cy	110	860
1.2 KW	GE	1 ph 14½ cy	110	860

BOILER FEED PUMP

Worthington size 12 x 7½ x 15 300# water press. 175# steam. duplex plunger type.

SPECIAL MOTORS

2—25/65 HP Wtg. oil well type 3/60/440 volts, 570/1160 RPM, style 88C138, with controls, real bargain.

SYNCHRONOUS CONDENSERS

3 ph. 60 cy.

1000 HP Wtg. 3/60/440 volts 900 RPM
2000 HP GE ATI 3/60/11000 v. 600 RPM

ENGINE SET-UNIFLOW

800 KW GE type ATB 3/60/480 volts, 200 RPM 175# pressure, condensing, chain driven exciter, control panel, with Skinner universal uniflow engine—well cared for.
500 KW GE MPC 250 volts DC generator, with Skinner uniflow engine.
500 HP Winton gas engine 8-cylinder overhead valve type, can furnish with AC generator.

ROTARY CONVERTER

200 KW Gen. Elec. 250/275 volts DC 6 phase 60 cycle, 440 volts AC with switchgear and transformer equipment.
500 KW GE (2) 240/275 volts DC 6 phase 60 cycle, 2200/4000Y AC, with switchgear and transformer equipment.

25 Cy. M.G.'s,

75 KW GE 125 v DC 3/25/440 AC 750 RPM interpole.
75 KW GE 125 V. DC 3/25/220 v 750 RPM 2-brg.

FREQUENCY CHANGERS

500 KVA Westinghouse with 583 HP 3/25/2200/575/440/220 v. 750 RPM syn. motor 500 KVA 3/62½ cy. 2300/440/220 syn. gen. both machines amortisseur equipped, can be operated from 60 cy. to furnish 24 cy.

TRANSFORMERS

2—5000 KVA 3/60/OISC 13800 pri 2300 v sec.
3—750 KVA GE 1/60/13890 pri 2200 v sec.
2—100 KVA GE 1/60 4600 to 120/240 v sec.
9—75 KVA Wtg. 1/60 3810 pri 240/122 sec.

WE PURCHASE ELECTRICAL & POWER EQUIPMENT OF ALL KINDS

CHICAGO ELECTRIC CO.

1320 W. 22ND ST.
CHICAGO, ILLINOIS

POWER PLANT EQUIPMENT CO., INC.

39 Cortlandt Street
New York, N. Y.

AC TURBINE UNITS

5000 KVA G.E. 2300/4000 V., Cond.
1875 KVA G.E. 2300 V., Cond.
1250 KVA (2) G.E. 2300/4000 V., with surface Condensor.
937 KVA G.E. 2300/600 V., Non-Cond.
937 KVA G.E. 2300 V., with Surface Condensor.
937 KVA A1. Chal.—Elliott, 480/240 V., cond. or mixed pressure; with Jet Condensor, etc.
780 KVA A1. Chal. 2300 V., with Surface Condensor, Rado-Air Ejectors, etc. NEW, never in service.
625 KVA Wghse. 2300 V., with Surface Condensor, etc.
625 KVA Al. Chal. 2 ph., 2400 V; Jet Condensor, etc.
625 KVA GE. 2300 V.; Bleeder; Condensor, etc.
625 KVA A1. Chal.—Elliott, 240/480 V., Automatic Bleeder, with Jet or Surface Condensor.
625 KVA Wghse. 2400 V., with Jet Condensor, etc.
375 KVA G.E. 2300 V., non-cond.
375 KVA Al Chal. 2 ph., 2400 V., with Jet Condensor.
375 KVA G.E. 2300 V., Bleeder, with Jet Condensor.
312 KVA Ridgeway-Elliot 480/240 V., with Jet Condensor.
150 KVA Wghse. 240/480 V., Jet Condensor.

AC ENGINE UNITS

450 KVA Wghse. 18x36 Filer Stowell Corliss
375 KVA G.E. 22x27 Erie Ball 4 V.
312 KVA Elec. Mchy. 20x24 Chuse Uniflow ..
312 KVA Wghse. 21x22 Skinner Uniflow
300 KVA G.E. 18x36 Murray Corliss
250 KVA G.E. 18x42 Hewes-Philips Corliss
250 KVA G.E. 17x20 Erie Ball 4 V.
200 KVA G.E. 21x22 Skinner Uniflow
200 KVA Al. Chal. 14x36 Al. Chal. Corliss
125 KVA G.E. 14x15 Skinner Uniflow
112 KVA G.E. 14x18 Erie Ball 4 V.
100 KVA G.E. 14x16 Skinner Uniflow
60 KVA G.E. 12x12 Skinner Uniflow

DIRECT CURRENT UNITS

KW	Gen.	Volts	Engine
1000	Al. Chal.	250	Al. Chal.
500	C.W.	250	Hamilton Unif.
300	G.E.	250	Skinner Unif.
300	Wghse.	250	Murray Corliss
200	Wghse.	250	Turbine
200	G.E.	250	Skinner Unif.
200	G.E.	125	Erie Ball 4 V.
150	C.W.	125	Erie Ball 4 V.
125	G.E.	250/125	Erie Ball 4 V.
100	C.W.	250	Erie Ball 4 V.
100	G.E.	125	Erie Ball 4 V.

BOILERS (ASME)

728 HP E.C. Vert. 200#
685 HP Sterling 200#; Harrington Chain Grate Stokers
500 HP Murray (Heine) 200#
502 HP (2) Edgemoor (Heine) 225#
484 HP Springfield Cross Drum 200#
471 HP Erie City Vert. 200#
420 HP Sterling, 200#
407 HP (2) Erie City bent tube, 250# 'National Board"
323 HP (Two) Sprinfigeld Cross Drum, sectional header, 200#; with Gas and Oil Burners, also Type "E" Underfeed Stokers.
320 HP Sterling, 200# with Detroit Underfeed Stokers
300 HP Heine 175#
295 HP (3) Sterling, 200#

TRANSFORMERS

2—678 KVA Maloney 13,800/460 V.
2—500 KVA Maloney 2200/220 V.
Complete Transformer Station; including (3) 333 KVA Transformers 11,000/22,000/33,000—115/230/460 V.
300 KVA, 3 ph. 13,200/6600-220/440 V.
(4) 200 KVA Wghse. 13,200-4000/2300 V.
3—100 KVA G.E. 6600/13,200-230/460 V.
3—100 KVA Al. Chal. 22,000/440 V.
3— 75 KVA Wghse. 11,000/440 V.
3— 75 KVA G.E. 13,200-115/230 V.

ROTARIES

1500 KW Wghse. 600 V.—3 ph. 60 cycle
1000 KW G.E. 600 V.—3 ph. 60 cycle
500 KW G.E. 600 V. 3 ph. 60 cy.
400 KW (2) G.E. 250 V. 3 ph. 60 cy.
300 KW G.E. 600 V. 3 ph. 60 cy.

FREQUENCY CHANGERS

625 KVA Wghse. 60-25 cycles
625 KVA G.E. 25-60 cycles

GAS & DIESEL UNITS

1000 KVA G.E. 3 ph. 60 cy.; with Cooper Bessemer Nat. Gas. Engine
375 KVA Wghse. 3 ph. 60 cy.; Busch-Sulzer
250 KVA F.M. 3 ph. 60 cy.; Style VA
200 KVA G.E. 3 ph. 60 cy.; Busch Sulzer Diesel
168 KVA Ideal 3 ph. 60 cy.; Fulton 3 cyl. Diesel Engine; dir. con. exciter

OIL HEATING & PUMPING UNIT

Suitable for 1000 HP to 5000 HP in Boilers

STEAM ENGINES (belted)

20 x 21 Skinner Uniflow; practically new; 150-175 lbs. initial; 15 to 25 lbs. B.P.

TWIN ENGINE, 1200 HP, 22 cyls., 22x32 Nordberg Unif., 160 to 250 lbs., up to 40 lbs. B.P.

LOCOMOTIVE CRANE

Gasoline Operated. Mounted on Creeper Truck; bucket ¾ cu. yd.

TURBOS 60 cy

1—4000 KW GE 7-stage double bucketed 60/3/6600/1800 RPM 150/200# ISP. Surface Condenser, exciter and pasels.

2—3125 KVA Lynn Type GE Rigid Frame 4-stage 60/3/2300/3600 RPM. Surface Condenser equipped. Unique minimum log service.

1—1000 KW 80% PF GE Curtis Form B 60/3/4800 Y connected /3600 RPM. Turbo 4-stage 225# 200° Superheat condition. Has recently operated NC at full load 15# Gauge. Self-contained exciter, no condenser available. Unit reported like new.

1—625 KVA Wemco 10-C Parsons or NC 60/3/440/2200/3600—Jet Condenser—Surface available.

1—300 KW Wemco Single Wheel Re-entry 6-/3/240-120/250#.

TURBOS 25 cy

6250 KW 80% PF Parsons design Multiple Expansion Parallel Flow 25/3/4000/1500 RPM, Surface Condenser equipped.

6000 KW GE Curtis 25/3/6600/1500 RPM, Jet Condenser equipped.

2—7200 KVA Wemco Impulse and Reaction Semi-Double Flow 25/3/11000/1500 RPM. Surface Condenser equipped.

1—4000 KW 80% old rated (log service record 7500 KW) Wemco Impulse anl Reaction design 25/3/13200/1500 RPM. Surface Condenser equipped.

2—3500 KW Wemco 25/3/13200/1500 RPM with combined 18000 sq. ft. Surface Condenser.

2—2000 KW Wemco Parsons Multiple Expansion Parallel Flow 25/2/6600/1500 RPM.

TURBOS DC

1—500 KW GE Mixed Pressure 16 to 140# 250 volts DC. Surface Condenser 3100 sq. ft.

500 KW Wemco 125/175# 600 V DC-geared turbo 3600/720 RPM, Surface Condenser.

MOTOR GENERATORS

1—1500 KW GE MPC 60/3/4000 to: 600 volts DC.

ROTARY CONVERTERS

2—1000 KW Wemco 60/6/6500 DC—900 RPM.

1—2000 KW Wemco Shunt wound, Booster type, Syn 25/3/191: 270 DC—300 RPM. Transformers 4000: 191 volts.

3500 KW G.E. Syn Booster 3/6 ph.. 250 DC—167 RPM. Transformers 11,000: 196 volts.

BOILERS

9—600 HP B&W Vertical Steel Header Longitudinal 3-drum 200# Superheater and Taylor Stokers.

6—600 HP Stirling 4-drum 200# pressure chain grate Stokers.

3—500 HP Egdemoor Steel Header Boilers—200#—Foster Superheaters.

3—500 HP B&W Stirling 200# ISP superheaters.

2—484 HP Springfield Horiz. ASME Straight Tube Longitudinal Cross Drum Boilers, one 200#, the other 225# and with Wemco Stoker.

1—400 HP B&W Stirling 200# no superheater.

THE PICK OF POWER EQUIPMENT

TURBO UNITS—60 Cy.
1—4000 KVA Allis Chalmers Cond.
1—3125 KVA General Electric Cond.
1—2850 KVA Westinghouse Cond.
1—2500 KVA General Electric Cond.
1—1563 KVA General Electric Cond.
1—1250 KVA General Electric Cond.
1— 937 KVA General Electric Cond.
1— 750 KVA Terry Double Extr. Cond.
3— 625 KVA General Electric Cond.
1— 625 KVA General Electric Extr. Cond.
1— 375 KVA General Electric Cond.
1— 250 KVA General Electric Cond.
1— 938 KVA West. 375# I.P. 100# B.P. N-C.
1— 375 KVA General Electric Non-C.
1— 312 KVA Moore Non-Condensing
1— 125 KVA Westinghouse Non-C.

STEAM ENGINE UNITS—60 Cy.
1—1067 KVA Nordberg Uniflow
2— 937 KVA Nordberg Uniflow
1— 500 KVA Rice & Sargent Corliss
1— 325 KVA Skinner Uniflow
1— 312 KVA Fitchburg 4-valve
1— 300 KVA Hamilton 4-valve
1— 250 KVA Harrisburg Uniflow
1— 150 KVA Hamilton Poppet Valve

DC STEAM ENGINE UNITS
1—500 KW Skinner Uniflow 250 V.
1—300 KW Skinner Uniflow 250 V.
1—250 KW Skinner Uniflow 250 V.
1—200 KW Chuse 4-valve 250 V.
1—150 KW Erie Ball 4-valve 250 V.
1—150 KW Ames Uniflow 125 V.
1—100 KW Ames Uniflow 120 V.
1— 75 KW Skinner Uniflow 250 V.
1— 50 KW Ames Uniflow 125/250 V. 3-wire

OIL & GAS ENGINE UNITS—60 Cy.
1—1000 KVA Nelseco Diesel 2300 V.
1— 603 KVA Fair.-Morse 480 V.
1— 400 KW West. (gas) 440 V.
1— 375 KVA Ing.-Rand 230°/440/220 V.
1— 237 KVA Fair.-Morse 480 V.
1— 100 KVA Buckeye 240/480 V.
1— 93.5 KVA Anderson 2300 V.
1— 75 KVA Fair.-Morse 2300 V.
1— 40 KVA Fair.-Morse 2300 V.

WATER TUBE BOILERS
6—600 HP Stirling 180-lb. Stokers
2—520 HP Heine 200-lb. Hand Fired
1—512 HP Erie City 175-lb. Oil Burner
2—511 HP Union 200-lb. Stokers
1—500 HP B. & W. 200-lb. Stoker
2—500 HP Stirling 200-lb.
2—407 HP Erie City 250-lb. Stokers
2—357 HP Casey-Hedges 175-lb. Stokers
2—282 HP Edge Moor 200-lb. Stokers
2—254 HP Stirling 180-lb. Stokers
2—160 HP Stirling 155-lb. Hand Fired

SYNCHRONOUS MOTORS—60 Cy.
2—800 HP Electric Machy. 6600 V. 450 RPM
1—225 HP General Electric 2200 V. 225 RPM
2—200 HP General Electric 440 V. 277 RPM
1—175 HP General Electric 440 V. 277 RPM
1—100 HP General Electric 440 V. 277 RPM

INDUCTION MOTORS—60 Cy.
2—400 HP G. E. slip ring 3800 V. 188 RPM
1—350 HP G. E. sq. cage 4000 V. 900 RPM
2—300 HP G. E. sq. cage 440 V. 600 RPM
2—250 HP G. E. sq. cage 4000 V. 1200 RPM
5—150 HP West. sq. cage 440 V. 900 RPM

AIR COMPRESSORS
1—3500 Ft. 100-lb. Ing. PRE2, 60 cy. motor
1—3300 Ft. 100-lb. Ing. PRE2, 60 cy. motor
1—2600 Ft. 100-lb. Ing. PRE2, 60 cy. motor
1—2100 Ft. 65-lb. Worth. 60 cy. motor
1—1300 Ft. 100-lb. Sul. Diesel
1—1200 Ft. 100-lb. Ing. 2-stage, belt driven
1—1051 Ft. 103-lb. Sul. WN32, 60 cy. motor
2— 600 Ft. 100-lb. Ing. POC2, Diesel

OIL CIRCUIT BREAKERS
1—800 A. 87 KV Am.Br.Bov. AF22 Outdoor
2—600 A. 73 KV West. G222AS Outdoor
1—400 A. 73 KV G. E. FK036 Outdoor
4—400 A. 34.5 KV Condit D-16-A Outdoor
2—1000 A. 30 KV Kelman CB-76 Outdoor
2—600 A. 30 KV Kelman CB-76 Outdoor
1—400 A. 25 KV G. E. FK0136 Outdoor
2—600 A. 15 KV Kelman CB-76 Outdoor
1—400 A. 15 KV G. E. FK037 Outdoor

FREQUENCY CHANGERS
2—3125 KVA West. 25/62½ cy. 750 RPM
1—3000 KVA West. 60/25 cy. 300 RPM
1—2500 KVA West. 25/60 cy. 300 RPM
1—1500 KW G. E. 25/60 cy. 300 RPM
1—1250 KVA G. E. 25/62½ cy. 375 RPM
1—1000 KVA G. E. 60/25 cy. 514 RPM
2— 750 KVA G. E. 25/60 cy. 300 RPM
1— 500 KVA G. E. 25/60 cy. 300 RPM

ROTARY CONVERTERS—60 Cy.
2—1000 KW General Electric, 600 V.
1— 500 KW General Electric, 250 V.
1— 500 KW General Electric, 600 V.
2— 300 KW General Electric, 600 V.

SYNCHRONOUS CONDENSERS
1—4000 KVA G. E. 13200 V. 514 RPM
1—2000 KVA G. E. 11000/2200 V. 720 RPM
1—2000 KVA C. W. 11000 V. 600 RPM
1—1000 KVA G. E. 2300 V. 900 RPM
1— 500 KVA West. 2200 V. 900 RPM

TRANSFORMERS—1 Ph. 60 Cy.
3— 600 KVA West. 120,000/2300 V.
2— 1000 KVA West. 66000/2300 V
3— 1000 KVA Wagner 33000/2300 V.
3— 500 KVA Allis 33000/480 V.
2— 1000 KVA G. E. 23000-11500/575 V.
3— 100 KVA G. E. 22000/6900 V.
1—10000 KVA Pitts. 13200/4610 V. 3 ph.
2— 5000 KVA American 13800/2300 V.
5— 1000 KVA G. E. 13800/2300 V.
1— 450 KVA G. E. 13200/240-480 V. 3 ph.
4— 200 KVA West. 13200/2300-4000 V.
3— 150 KVA Pitts. 13800/230-460 V.
3— 75 KVA West. 13800/230-460 V.
3—1000 KVA Packard 11000/2300-4000 V.
3— 150 KVA Pitts. 11000/2400 V.
3— 100 KVA West. 11000/250-125 V.
1— 3300 KVA G. E. 6600/110 V. 3 ph. Furnace
3—1250 KVA G. E. 6600/550 V.
1—1500 KVA West. 6600/106 V. 3 ph. Furnace
3— 100 KVA G. E. 6900/440-220 V.
3— 833 KVA Penn. 4800/120-240 V.
3—1000 KVA Pitts. 2300-4600/550 V.
6— 50 KVA G. E. 2400/240-120 V.

PARTIAL LIST—WE HAVE ALL CLASSES OF POWER EQUIPMENT

BREW, WOLTMAN & CO., INC.

50 CHURCH STREET, NEW YORK CITY

MOTORS • GENERATORS • TRANSFORMERS

Prices on Application

3 PHASE—60 CYCLE 220/400 VOLT

H.P.	Make	RPM	Type	Frame
15	Allis-Chalm.	1750	2K54411	
20	Gen. Elec.	1750	KT	753
20	Gen. Elec.	600	I	K
25	Burke	900	EM	
40	Gen. Elec.	900	KT	336
40	Burke	1200	EM	45
40	Westing.	1750	CS	
50	Westing.	900	CS	
50	Gen. Elec.	900	KT	542
60	Burke	900	EM	7
60	Gen. Elec.	1200	I	K
60	Gen. Elec.	1800	I	K
75	Gen. Elec.	1200	KT	343
5) 75	Gen. Elec.	1200	I	K
75	Gen. Elec.	1800	I	K
75	Gen. Elec.	900	I	K
100	Burke	720	EM	10
100	Gen. Elec.	1750	I	K
100	Westing.	900	CS	
100	Lincoln	1200		
150	Gen. Elec.	1200	I	
150	Westing.	900	CS	
200	Gen. Elec.	600	I	K
200	Gen. Elec.	720	I	K
200	Gen. Elec.	900	I	K
200	Gen. Elec.	1200	I	K
250	Gen. Elec.	600	I	K
250	Gen. Elec.	720	I	K
250	Allis-Chalm.	900		
300	Gen. Elec.	720	I	K

Compressors in stock up to 300 H.P.

AIR COMPRESSORS

1—14"x9"x12" Imperial-Type Ingersoll-Rand two stage 100 lb. pressure belt drive.
1—16"x10"x14" Imperial-Type Ingersoll-Rand two stage 100 lb. pressure belt drive.

BARGAIN
30—3 HP. General Electric Motors. 3/60/220/3600 rpm. $37.00 each.

100 K.V.A. GENERATOR For Diesel Use
1—100 KVA Crocker Wheeler 3/220/60 cy. 257 RPM. For Direct connection to Diesel. 2 Bearing Machine with exciter and panels.

ANODIZING M. G. SET
1—1000 Amp. 60 Volt General Electric Generator, Type CD-115Y, 1200 RPM, direct connected to 90 H.P. General Electric Synchronous Motor, 3 phase, 60 cycle, 440 volt, 1200 RPM; 3-bearing Factory built machine, complete.

SPECIAL MOTORS

1100 H.P. General Electric Synchronous Motor, 3 ph., 25 cy., 11,500/6600/2200 V., 375 RPM.
1—500 H.P. Gen. Elect. Sync. 3/2200/60/1200 R.P.M. with Exciter. New.
500 H.P. Allis-Chalmers, 3 ph., 25 cy., 440 V., 490 R.P.M., Complete.
300 H.P. G.E. Slipring, 25 cy., 3 ph., 2200 V., 500 RPM, 3 bearing; complete with controls.
225 H.P. Electric Mchy. Co. Synchronous, 3 ph., 25 cy., 2200 V., 500 R.P.M. with controls.
2—100 H.P. G.E. Synch. Motors, 3 ph., 25 cy., 220/440 V., with control equipment.

FREQUENCY CHANGERS

1—600 KW Gen. Elec. Syn. 2300 V., 25 cy. to 2300 V. 60 cy.
1—565 KVA Westinghouse Synch. 2200 V. 25 cy. to 220 V. 3 Ph. 60 cy.
2—400 KW General Electric Synch. 6600 V., 25 cycle to 440/2300 V. 60 cy.

TRANSFORMERS

Amt.	KVA	Make	Cycle	Voltage
3	40	Gen. Elec.	25	2200/440
3	50	Gen. Elec.	60	2200/220/440
2	75	West.	60	2200/120/240
3	100	Gen. Elec.	60	24/120/240
2	100	Gen. Elec.	60	4600/115/230
3	200	Gen. Elec.	25	13,200/240/480
3	333	Gen. Elec.	60	6900/230/460
3	500	Gen. Elec.	60	2200/220/440
3	500	Pittsburgh	25	11,500/100
3	833	Gen. Elec.	60	13,800/460
3	1000	Pittsburgh	60	2300/4600/115
3	1000	KVA. Wagner	60	33000/2300

All sizes and Voltages Available.

SLIPRING MOTORS

60 CYCLE, 3 PHASE, 220/440 VOLTS

H.P.	Make	Type	Frame	RPM
300	Gen. Elec.	I	Form M	1185
75	Gen. Elec.	MT	537	1800
60	Gen. Elec.	MT	353	1800
60	Gen. Elec. (2)	MT	353	720
50	West.	CW	654C	1800
50	West.	CW	644C	900
50	West.	CW	654C	1800
40	Wagner	22WB		540
40	West.	CW	748	690
40	West.	CW	748	690
40	West.	CW	748	690
30	West.	HF	8B	1745
30	Gen. Elec.	MTC		1725
25	Gen. Elec.	MT	513	1800
25	Gen. Elec.	I	M	1200
25	West.	CW	750C	575
20	West.	CW	648A	575
20	West.	CW	644C	575
20	Gen. Elec.	MT	332	545
20	West.	CW	748A	575
20	West.	CW	748A	575
20	West.	CW	748A	575
15	Gen. Elec.	I-M		1725
15	Gen. Elec.	ITC		1725
10	Gen. Elec.	MT		1725

25 CYCLE, 3 PHASE, 440 VOLTS

H.P.	Make	Type	Serial	RPM
150	Gen. E ec.	MT563Y	5056230	725
125	Gen. Elec.	I-17	4550934	360
50	Gen. Elec.	MT547	5264084	720
50	Gen. Elec.	MT353	3879210	750
50	Allis-Chal.		7923K	715
52	Gen. Elec.	ITC5013	1773223	700
40	Gen. Elec.	MT543	4817983	750
40	Gen. Elec.	MT343	3887755	760

GENERATOR & EXCITER

1—62½ KVA 3 ph. 60 cy. 240 v. 1200 rpm Allis-Chalmers generator, serial No. 113797, with exciter, direct Connected stock No. E11317. Comp. with Base Pulley and Panel.

ERIE ELECTRIC CO., INC.

124 CHURCH ST. BUFFALO, N. Y. CL. 4758

SUCCESSFUL OPERATION GUARANTEED

Every Machine in This Ad is Owned Outright By Us

D C MOTORS

230 Volt—Constant Speed

	HP	Make	Type	Speed
1—	300	Cr. Wh.	CCM-108H	550
1—	250	Al. Ch.		525
2—	200	Whse.	SK	400
1—	200	G.E.	DMC	475
1—	150	G.E.	MPC	275
1—	140	G.E.	MDS-108	410
1—	125	G.E.	CDP-123	1750
3—	100	G E.	LC-50	1200
1—	100	G.E.	RC-38	600

230 Volt—Adjustable Speed

1—	600	Whse.		150/275
1—	300	G.E.	MPC	250/400
1—	300	G.E.	MPC	275/550
2—	275	G.E.	DMC	500/750
1—	200	Whse.		400/500
1—	150	G.E.	MPC	250/450
1—	100	Al.Ch.		950/1150
1—	75	Whse.	SK	475/900
1—	75	G.E.	CD-145	575/865
1—	75	Cr.Wh.	65H	600/1200
1—	75	G.E.	C	500/1000
2—	60	El.Dy.	S	525/1050
2—	50	Cr.Wh.	CMC-81H	300/900
1—	45	G.E.	CD-125	450/1350
24—	30	Whse.	SA	500/1500
1—	25	Cr.Wh.	50H	335/1000

TRANSFORMERS

	KVA	Make	PH	Type	Voltages
1—	1500	Whse.	3	OISC	26400/13200x460
3—	1000	G.E.	1	HKDD	13800x2300
3—	333	Pitts.	1	OISC	13800x440/220
3—	300	G.E.	1	H	13200x2300/575
3—	300	Pkd.	1	OISC	2300x460
2—	200	Whse.	1	SK	6900x230/460
3—	200	G.E.	1	H	26400x115/460
3—	100	Whse.	1	OISC	13200x250

ENGINE GENERATOR SET

1—100 KW, Whse. D.C. Gen. 125/250 v. 3 wire 250 R.P.M. dir. Conn. 150 H.P., 14x15 Skinner steam engine 150# press

MOTOR GENERATOR SETS

3 phase—60 cycles

1—1500 KW Whse. 250 V. Gen. d.c. to 2100 HP 2200/4400 V. syn. motor.
1—1500 KW G.E. 600 v. Gen. d.c. to 2100 HP 6600 v. syn. motor.
1—500 KW G.E. 600 v. Gen. d.c. to 700 HP 13200 v. syn. motor.
1—500 KW G.E. 600 v. Gen. d.c. to 700 HP 2300 v. syn. motor
1—200 KW Al. Ch. 3 units; 2—100 KW 250 v., Gen. d.c. to 220 KVA 2200 v. syn. motor.
1—150 KW, G.E., 550 V., Gen. d.c. to 225 H.P., 2200 V. syn. motor.
1—125 KW, G.E., 275 V., Gen. d.c. to 190 H.P., 2200 V., syn. motor.

TURBO GENERATOR SET

1—500 KW, Whse., 625 KVA, 480 v., 3 ph., 60 cy. generator with Curtis single stage 160/125 pound non-condensing turbine good for 5 to 10 pounds back pressure
1—500 KW, G.E., 625 KVA, 2300 v., 3 ph., 60 cy. generator with Curtis 4 stage, 150 pound condensing turbine complete with condenser, etc.

ROTARY CONVERTERS

60 Cycle

2—1500 KW, Whse. 720 RPM 650 v. DC with 3-single phase, 33000 v. transformers and panel.
1—1500 KW Whse 720 RPM 600 v. DC with 1- three phase 11500 v. transformers and panels
2—1000 KW whse. 900 RPM 650 v. DC with 3- single phase 11800 v. transformers and panels.
2—1000 KW, G.E. HCC 900 RPM 600 v. DC with 1-three phase, 11000 v. transformer and panels
1—750 KW Whse 720 RPM 250 v. DC with three phase 6600/2300 v. transformer and panels.
1—500 KW, Westinghouse, 900 RPM, 125/250 volt, DC, with 3- single phase, 60 cycle, 13200/6600/2300 volt transformers and panels
1—300 KW, G.E., type HCC, 1200 RPM., D.C., 600 V, AC, 6 ph., 1200 RPM.

A C MOTORS

3 phase—60 cycle

Synchronous

	HP	Make	Type	Volts	Speed
1—	500	G.E.	TS	440	360
1—	350	Cr.Wh.	301	2200	600
1—	300	G.E.	ATI	440	600
1—	300	G.E.	ATI	2300	600
1—	250	G.E.	ATI	220	450
1—	200	Whse.		440	514
3—	150	G.E.	TRB	220x440	450
1—	150	Whse.		2200/550	1800
1—	100	Whse.		2200/550	1800
1—	100	Whse.	HP	220	300
1—	100	Whse.	G	2300	900

Slip Ring

1—	1000	G.E.	IM	2200	720
1—	600	G.E.	IM	2200	900
1—	600	Al.Ch.	ANY	2200	1180
1—	450	Whse.	CW	2200	875
1—	400	G.E.	MT	550/440	300
1—	400	Al.Ch.		2300	505
1—	300	G.E.	IM	2300	585
1—	250	G.E.	MT-410	2300	400
1—	250	Whse.	CW	440	585
1—	250	G.E.	MT	4000/2300	257
2—	200	Whse.	CW	2200	514
1—	200	G.E.	IM	440	435
2—	175	G.E.	IE-15A	2200	880
1—	150	G.E.	IM	2200	695

Squirrel Cage

1—	500	G.E.	1-17B	2200	690
1—	400	G.E.	KT	2300	585
1—	300	Whse.	CS	550	580
2—	300	G.E.	IK	2300	600
1—	300	Al.Ch.		2200	1160
1—	250	Al.Ch.		220/440	1150
1—	200	Whse.	CS	440	580
1—	200	Whse.	CS	550	720
1—	200	Al.Ch.		2200	1750
1—	150	G.E.	IK	2200/440	900
3—	150	Al.Ch.	AN	220/440	1750

RE-NU-BILT BELYEA MOTORS

What are your requirements? units up to 5000 kw available in stock.

BELYEA COMPANY INC.

Main Office & Shop: 43 HOWELL ST., JERSEY CITY, N. J.

250 VOLTS D.C. POWER PLANT
For Immediate Delivery

- **1—250 KW RIDGEWAY UNIFLOW HORIZONTAL STEAM DRIVEN GENERATOR SET** with Ridgeway 385 HP Uniflow Steam Engine, Bore 22", Stroke 26", Flywheel 90" dia., 20" face, direct connected to RIDGEWAY 250 KILOWATT GENERATOR, 1000 Amps., 240 Volts on Load, 250 Volts full load, 175 RPM., mounted on heavy cast iron bed, with outboard bearing on Dynamo, Automatic Oiler, no piping or Electric Wire.

- **2—150 KW McEWEN STEAM TANDEM COMPOUND ENGINE AND GENERATOR SETS** 284 HP Horizontal Steam Tandem Compound Engine, 18" stroke, 14 and 23" Bore, 72" dia., 15" Face Flywheel, direct connected to THOMPSON-RYAN 150 KW GENERATOR, 250 Volts, 600 Amps., 200 RPM., Mounted on Heavy Cast Iron Bed, and Outboard Bearing on Dynamo, Left Hand Dynamo Drive.

SET UP AS OPERATED—COMPLETE WITH:

INTERCONNECTING PIPING, CONDENSER, CIRCULATING PUMPS, PANEL BOARD AND INSTRUMENTS

Ready for Immediate Delivery!

CONSOLIDATED PRODUCTS CO., INC.

18-19 PARK ROW **NEW YORK, N. Y.**

Our Shops and Yard at Newark, N. J. cover eight acres.

REBUILT POWER EQUIPMENT—Ready to Ship

ROTARY CONVERTERS

150 kw., West. 250 v. 1200 rpm., 2200 3 ph. 60 cy.

150 kva. G.E. 250 v. 1200 rpm., 440/3/60 type HCC.

MOTOR GENERATOR SETS

110 kw. Crocker Wheeler 250 v. 720 rpm., 2200/3/60 ind.

150 kw. Crocker Wheeler 250 v. 600 rpm., 220/440 v. ind.

56¼ KW 250 v. Westg. 600 rpm. 220/440 v. Ind.

ENGINE GENERATOR SETS

50 kw. West. 220/3/60 Ames Auto. Steam.

75 kw. G.E. 250 D.C. Skinner Uni. Steam.

100 kw. Fair Morse 2400/3/60 belted 2 cyl. DIESEL.

175 kw. G.E. 2200/3/60 dir. con. Ridg. STEAM.

175 kw. West. 2200/2/60 dir. con. Skinner Steam.

200 kva. Fair Morse 2400/3/60 dir. con. 4 cyl. DIESEL.

225 kw. Elec. Machy. 2300/3/60 Ideal 4 valve Steam.

300 kw. West. 250 v. D.C. Skinner Uniflow Steam.

D.C. GENERATORS—250 volt

30 kw. Allis Chal. 700 rpm.

80 kw. West. 265 rpm.

100 kw. G.E. 550 rpm.

150 kw. Crocker Wheeler 550 rpm.

100 HP. LIDGERWOOD HOIST

Double drum Speedwell 2500 lb. pull at 450' per min. direct driven by 100 hp. A.C. or D.C. Motor.

A.C. GENERATORS

219 kva. G.E. 2300/3/60 200 rpm. 80% P.F. (Can be reconnected 440 or 220 v.)

150 kva. Wagner 220/440 v. 3 ph. 60 cy. 600 rpm.

75 kw. G.E. 240/3/60 900 rpm. 80% P.F.

SPECIALS IN SLIPRING MOTORS 3ph. 60 cy.

HP	Make	Speed	Type
700	G.E.	393	MT-432
400	West.	1170	CW
300	G.E.	600	M
260	Burke	600	EM-65
250	G.E.	590	I-174
200	West.	690	CW-956A
100	West.	1750	CI

SYNCHRONOUS MOTOR

225 HP. G.E. 2200 v. 3 ph. 60 cy. 80% P.F. 200 rpm. (Can reconnect 440 or 220 v.)

TURBINE

1—Kerr Economy Steam Turbine 450 B.H.P. 3800 rpm. 5" intake, 12" exhaust with Kerr Reduction Unit 3800 to 720 rpm. 115 lbs. pres.

A.C. MOTORS—3 ph. 60 cy.

HP	Volts	Make	Type	Speed
800	2200	West.	Syn.	450
200	2200	G.E.	IK-15	1200
200	220/440	West.	CS	1200
200	220/440	West.	CS	720
200	220/440	West.	CS	600
225	2200	West.	CS	900
250	220/440	West.	CS	900
250	2200	West.	CS	1200
300	220/440	West.	CS	1150
300	2300	West.	CS	1200
300	2200/440/220	West.	CS	450
350	2200/440/220	West.	CS	450
400	2200/440/220	West.	CS	500
450	2200/440/220	West.	CS	600
500	2200/440/220	West.	CS	720
600	2200/440/220	West.	CS	900

CRANE MOTORS—230 V. D.C.

15 hp. Crocker Wheeler with electric brake 270 rpm

30 hp. Niles 650 rpm.

30 hp. Niles.

50 hp. West—38 B., 500 rpm.

GAS ENGINE GENERATOR SET

75 kw. West. 250 v. belted to 110 HP 2 cyl. Bessemer Gas Engine.

SPEED REDUCERS

23—3 to 10 HP Thomas, Ratio 100 to 1; 15 to 1; 10 to 1; 5 to 1.

5—10 HP. 600 At Cleveland ratio 90:1.

1—150 HP. R.D. Nuttal ratio 1.6:1.

TRANSFORMERS—1 ph. 60 cy.

1—100 kva. West. 2200-220/110.

2—75 kva. Burke 2200-110 v. 3 ph.

1—50 kva. Burke 2200-110 v. 3 ph.

2—50 kva. G.E. 2200-220/440 v.

3—37½ kva. West. 22000-2200.

6—10 kva. Pgh. 2200-220/110.

DUQUESNE ELECTRIC & MFG. CO., Pittsburgh, Pa.

TRANSFORMERS — For Sale

IMMEDIATE DELIVERY — NOW IN STOCK

6—Single Phase General Electric, Type A, Form L, 400-KVA, 60-cycle: Volts 12200-13200-14200/550-575-600.

4—Single Phase General Electric, Type H, Form L, 400-KVA, 60-Cycle, Volts 12200-13200-14200/550-600-2200-2400.

3—Single Phase General Electric, Type H, Form KDD, 500-KVA, 60-Cycle, 14200/600-2400.

WILMS, WEAVER & COMPANY

1526-28 UNION GUARDIAN BUILDING — DETROIT, MICHIGAN

Telephones: Cadillac 1340 - 1341

TURBO GENERATORS

1—937 KVA, 750 KW, 3 ph., 60 cy., 2300 V., 3600 rpm Gen. Elec. complete with C. H. Wheeler surface condenser pumps, radiojet.

1—625 KVA, 500 KW, 3 ph., 60 cy., 480 V., 3600 rpm, Gen. Elec. with direct connected exciter.

1—same in 2300 volts.

GAS ENGINE UNIT

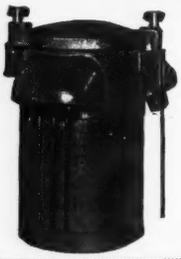
1—140 KVA, 98 KW, .7 P.F., 60 cy., 277 rpm, Gen. Elec. with direct connected exciter to 4 cylinder Foos engine. Has gasoline attachment.

The above are just a few of the thousands of items we have in Motors, Generators, Turbo Generators, Engine Generators, Motor Generators, Transformers, Circuit Breakers, etc. Please send us your inquiries. What have you for sale?

George Sachsenmaier Co.

8403 Hegerman St. Phila., Pa.

—TRANSFORMERS—



TRANSFORMERS WANTED

in operating condition or burnt out. Mail us list giving complete nameplate data and stating condition.

We Rewind, Repair and Redesign all Makes and Sizes
ALL TRANSFORMERS GUARANTEED FOR ONE YEAR
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THE ELECTRIC SERVICE CO., INC.

"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
STATION M — Since 1912 — CINCINNATI, OHIO

COMPLETE POWER PLANT

Consisting of 3—500 KW **General Electric** 3600 rpm, 5 stage, 175 lb. Condensing, 3 phase, 60 cycle, 2300 volt **Turbo Generators.** With surface condensers, complete auxiliaries. Also 3—300 HP, 200 lb. Heine Watertube Boilers, superheaters, oil burners, pumps, transformers, switchboards and steel buildings. Excellent condition.

1000 KW **Allis Chalmers Turbo Generator.** 1800 rpm, 3-60-440 V. Condensing with 3200 ft. Surface Condenser. Also suitable non-condensing.

Mississippi Valley Equipment Co.

507 Locust St. — St. Louis, Mo.
"What do you Need or Have to Sell?"

ENGINE GENERATOR SETS

1—160 KW West. 3/60/480 Belted Exct. Dir. con. Chuse left hand 4 val. non-release eng. 17x21.
1—312 KVA West. 3/60/2300 v. belt, exct. dir. con. Murray Special Corliss left hand eng. 18x30.

AIR COMPRESSORS

1—610 c. ft. I.R. St. Dr. 100# air, 150# stm.

SURFACE CONDENSERS

2—10 AD 4 pass 210 ft. Foster Wheeler over Comb. Air Circulating and Tail pump.

STEAM PUMPING ENGINES

1—Snow 6 mgd C&FW Cr. Com. Opp. Type Cond. 20-40x14¾x36, with waterwork type cond.
1—Allis-Chal. 4 mgd. cr. com. cond. Size 12x28x13x24. Fine cond.

PUMPS

Worth Dup. Pump size 16x12x12, cap. 1100 gpm. heavy water wks. type.

BIRCH MANUFACTURING COMPANY

1523 Sedgwick St. — Chicago, Ill.

SYNCHRONOUS CONVERTERS

500 KW West. 250 D.C. 2300/4000 A.C. 1200 RPM
300 KW G.E. 600 D.C. 2300/4000 A.C. 1200 RPM
200 KW Al-Ch, 250 D.C. 2300/4000 A.C. 1200 RPM
200 KW R.W. 250 D.C. 2300/4000 A.C. 1200 RPM
150 KW R.W. 250 D.C. 2300/4000 A.C. 1200 RPM

SYNCH. MOTOR GENERATORS

200 KW G.E. 250 V. 2300 A.C. 720 RPM
150 KW R.W. 250 V. 2300 A.C. 900 RPM
100 KW WEST. 250 V. 2300 A.C. 900 RPM

IND. MOTOR GENERATORS

300 KW G.E. 250 V. 440 A.C. 720 RPM
200 KW G.E. 250 V. 440 A.C. 720 RPM

Each unit listed above is owned by us and is Available now for immediate purchase.

WALLACE E. KIRK CO.

Incorporated

502 Grant Building Pittsburgh, Pa.

TRANSFORMERS

A new Lot of Reconditioned Transformers acquired—200KVA and down. Let us have your inquiries.

Electric Apparatus Repair Co.

Specialists on Rebuilding Motors, Generators and Controls

1410 No. 6th St., PHILA., PA.

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180 H.P. Worthington **Diesel Engine Generator Set** Solid injection, 3 Cyl., 2 Cy., 327 R.P.M., 12½ x 13¼. Direct Conn. to 100 K.V.A., 3 Ph., 60 Cy., 240 V, Type ATI, .8 P.F. GE Gen., Gen. #4703807. Belted to 6 K.W. G.E. Exciter, Type CD, 125 Volts. Complete with switchboard, exhaust muffler Griscom-Russell Multi-Whirl Cooler. Also, Power take-off, clutch and pulley formerly used to drive 60 Ton Ice Machine.

ALJON ELECTRIC DIESEL CO.

151-5 Washington St., Main 4-3804-5, Bklyn, N. Y.

TANKS—BOILERS—TURBINES

50,000 Gallon Steel Tank, 100 ft. tower.
2—1000 HP 275# Boilers. — 2000 KW Turbo Generator
New Boiler 600 HP 275# Pressure, ASME Code, 4 drum.
Vertical Construction Boilers, 50 HP.

WE BUY & SELL ALL TYPES OF BOILERS, STACKS & ENGINE GENERATORS

Write — Wire — Phone

H. A. WOODWORTH ENG'R'G. CO. 705 OLIVE ST. ST. LOUIS, MO.

AVAILABLE FOR DELIVERY NOW!

ENGINES

TWO—200 KW **Skinner Unaflow Engines** 150# pressure—0-10 lbs. back pressure, each connected to a 230 Volt D.C. Generator. 200 R.P.M. complete with panel boards.

ONE—500 KW **Hamilton Unaflow Engine** 26x36—175 lbs. pressure 0-10 lbs. back pressure. Connected to a Crocker-Wheeler Generator 230 V D.C. 150 R.P.M. complete with panel board.

ONE—**Chandler & Taylor** 13x16—80 H.P. Engine 200 R.P.M. 100 lbs. pressure.

GENERATORS

ONE—**50 KVA West Generator** 3 ph. 60 cy. 600 volt 1200 RPM with 3 kw. 125 V. SK Belted Generator with panel.

MISCELLANEOUS

ONE—**West. Voltage Regulator.** Type A-A-1.

FIFTY—**30" Exhaust Fans** 220 Volt 3 ph. 60 cyc. Only one year operation, new 1939.

BOILERS

2—360 H.P. WATER TUBE BOILERS
Installed 1933—Like New
APPROVED FOR 250% RATING
With Complete Pulverized Coal Fired Equipment Single Settings
Including Independent Unitype Motor Driven Pulverizers

This plant includes main steam header with all piping, expansion bends and valves
1500 H.P. closed type multi coil feedwater heater
2—Boiler feed pumps, brass fitted
All piping and fittings from feed pumps to heater and back to boilers is extra heavy brass—sizes from 2" to 5"
4—Unit Diamond soot blowers per boiler—steel breeching, coal and ash conveyors, magnetic separators
2—Bailey boiler meters

Numerous New Parts, New Tubes, Etc. Boilers in service only 5 years, used alternately.

ONE—**B & W Stirling W.T. Boiler** 200# pressure complete with Harrington Stoker—New—1926

MOTORS

ONE—**125 H.P. BTS Motor** 1150 R.P.M. 550 volt 3 ph. 60 cycle complete with Starter
THREE—**15 H.P. Type RC Motors** 230 V. 900 R.P.M.
EIGHT—**1½ H.P. SK 10 230 V.** 740-2200 R.P.M.
SIXTEEN—**1½ H.P. R. A. 230 V.** 820-1230 R.P.M.
ONE—**60 H.P. GE Slipring Motor** 550 Volt 3 ph. 60 cyc. 720 R.P.M.
ONE—**75 H.P. GE Sq. Cage Motor** 550 Volt 3 ph. 60 cyc. 900 R.P.M.
TWO—**5 H.P. GE Slip Ring Motors** 550 Volt 3 ph. 60 cyc. 1200 RPM.
TWO—**7½ H.P. West Vertical Motors** 550 Volt 3 ph. 60 cyc. 1200 R.P.M.

PUMPS

ONE—**6500 G.P.M. Gould Pump** 78 ft. head coupled to a 150 H.P. West. Type C.W. Slip Ring Motor. 208 volt 3 ph. 60 cyc. 1200 R.P.M. with automatic panel board.
ONE—**2100 G.P.M. DeLaval Pump** 130 ft. head 1800 R.P.M
ONE—**3500 G.P.M. DeLaval Pump** 130 ft. head 1800 R.P.M

FIFTEEN STRUCTURAL STEEL BLDGS. ALL SIZES SUITABLE FOR RE-ERECTION

TRANSFORMERS — MOTORS — TURBINES — GENERATORS — STEAM ENGINES — BOILERS

HEAT AND POWER COMPANY, INC.

670 SIXTH AVE. ***Chelsea 2-5415*** **NEW YORK CITY, N. Y.**

Get what you want IN A HURRY

from L. J. LAND & COMPANY, New York's Largest Stock of Electrical Equipment

A.C. EQUIPMENT

SYNCH. MOTORS

200 H.P. G.E. TS 514 RPM
90 H.P. Westinghouse 900 RPM
50 H.P. Elec. Mchy. 1200 RPM
47 H.P. West. 1200 RPM .7 PF

SLIPRING MOTORS

300 H.P. General Electric 720 RPM
200 H.P. General Electric 514 RPM
150 H.P. Allis Chalmers 720 RPM
2—125 H.P. G.E. 720 RPM
112 H.P. G.E. hoist 720 RPM
100 H.P. Fairbanks Morse 720 RPM
100 H.P. Allis Chalmers 720 RPM
100 H.P. Westinghouse 720 RPM
75 H.P. Westinghouse 1200 RPM
75 H.P. Allis Chalmers 600 RPM
60 H.P. Westinghouse 1200 RPM
60 H.P. General Electric 1200 RPM
60 H.P. General Electric 900 RPM
6 H.P. Westinghouse 300 RPM
4 H.P. GE. MT 900 RPM

SQUIRREL CAGE MOTORS

200 H.P. Allis Chalmers 1800 RPM
200 H.P. Allis Chalmers 1200 RPM
200 H.P. General Electric 600 RPM
150 H.P. Westinghouse 1800 RPM
100 H.P. G.E. 1200 RPM
100 H.P. General Electric 900 RPM
75 H.P. Westinghouse 900 RPM

A.C. GENERATORS

200 K.W. General Electric 600 RPM
125 KVA G.E. 900 RPM
100 KVA Crocker Wheeler 900 RPM
100 KVA Elec. Machy. 1200 RPM
75 KVA G.E. 1200 RPM
90 KW GE 900 RPM
15, 20, & 25 KVA 1200 RPM (8)

LOW & HIGH VOLT. GEN.

200 K.W. Wghse. 600 V. Mtr. Gen Set
2 to 40 K.W. 600 to 2000 V. M.G. Sets (11)
24 K.W. 60 V. General Electric
1 to 75 K.W. 10 to 80 V. (15)
12½ x 12, 390' Amer. Air Comp.

200 K.W. ELECT. MACHY. SYN. MOTOR GENERATOR SET

Motor: 300 H.P., 3 ph. 60 cy., 4000 V, 900 R.P.M.
Gen.: 200 KW, 250 V, 900 R.P.M. Complete A.C. and D.C. Control Equipment.

150 K.W. WESTINGHOUSE SYN. MOTOR GENERATOR SET

Motor—260 H.P., 3 ph., 60 cy., 220 V, 1200 R.P.M.
Gen.—150 KW, 125 V, 1200 R.P.M. Complete A.C. and D.C. Equipment.

100 KW Westinghouse Syn. MOTOR GENERATOR SET

Motor: 150 H.P. 3 ph. 60 c. 440 V 1200 RPM
Gen. 100 KW 250 Volt 1200 RPM—Complete AC & DC Control Equipment

14 x 10 Ingersoll Rand Air Comp.
1 Ton Shepard
15 to 50 K.W. Frequency Changers 90, 100, 120 cycle (7)
5 H.P. B & D D.C. Buffer Fans & Blowers (19)
Tirrell Voltage Regulators
165 KVA Aro Furnace Transformers

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Over Quarter Century Serving Industry

D.C. EQUIPMENT

230 V. D.C. MOTOR GEN. SETS

100 K.W. West. 1200 RPM
75 K.W. Elect. Machy. 1200 RPM
50 K.W. Burke 1200 RPM
45 K.W. Westinghouse 700 RPM

125 V. M.G. SETS

2—150 K.W. Westingh. Syn. Motor
40 K.W. Westinghouse
25 K.W. Gen. Elec.

230 V. D.C. MOTORS

75 H.P. General Electric 850 RPM
60 H.P. Sprague 900 RPM
60 H.P. G.E. 1000 RPM
60 H.P. Roth 600 RPM
50 H.P. G.E. 850 RPM
40 H.P. Reliance 625 RPM

330 V. VAR. SPEED MTR.

100 H.P. Crock. Wh. 550/900 RPM
75 H.P. Electro Dyn. 700/1050 RPM
35 H.P. West. 500/1500 RPM
30 H.P. West. 500/1500 RPM
30 H.P. G.E. 825/2000 RPM
25 H.P. G.E. CD 600/1200 RPM
15 H.P. G.E. RF 400/1200 RPM
15 H.P. West. .825/1650 RPM
15 H.P. G.E. 600/1800 RPM
15 H.P. Electro Dyn. 450/1350 RPM

115 VOLT D.C. MOTORS

90 H.P. General Electric 900 RPM
15 H.P. Eck 1500/1800 RPM
10 H.P. West. 1750 RPM

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M-G SETS 3 ph. 60 cy. (Syn.)

G. E. Booster M. G. Set consisting of 2—170 KW 85 V. Generators direct connected to 510 HP 230 V. DC Motor, all on common base with switchboards.

150 (2) KW Ridg. 275 v. DC—2200 v. AC 900 RPM

150 KW West. 550 v. DC—2200 v. AC—1200 RPM

100 KW G.E. 275 v. DC—2200 v. AC—1200 RPM

ENGINE GENERATOR SETS

100 KW 250 v. DC. Westgh.—Skinner Engine

1—50 KW 125 v. Al. Ch.—Ball Engine.

SYN. MOTORS 3 ph. 60 cy.

HP	Make	Volts	Speed
350	A.C.	2200	600
2-300	G.E. ATI-.88 P.F.	440	1200
225	Ideal (Unity P.F.)	440	900
1-175	Westgh. .8 P.F.	2200	600
2-75	G.E.	2200	900
75	Westgh.	220	1800

SLIP RING & SQ. CG. MOTORS (3 ph. 60 cy.)

HP	Make	Speed	Wdg.	Type
700	G.E.	393	S.R.	MT432
450	G.E.	257	S.R.	MT
400	G.E.	1800	S.C.	
300 (2)	G.E.	1200	S.C.	
300	G.E.	600	S.R.	I-M
200	Cr. Wh.	440	S.R.	28
200	Al. Ch.	600	S.C.	
125	Al. Ch.	435	S.R.	
125	Burke	1200	S.C.	
100	Burke	900	S.C.	
100	Lincoln	1200	S.C.	
100	F. M.	600	S.C.	BB
75	West.	575	S.R.	CW868A

DC VARIABLE MOTORS (230 VOLTS)

HP	Type	Make	Speed
75	SK	Westgh.	475/1425
20	SK	Westgh.	900/1800
10	SK	Westgh.	600/1200
5	SK	Westgh.	450/1800
2	SK	Westgh.	500/1800

300 HP D.C. VARIABLE SPEED MOTOR

Westgh. 230 v. 250/500 RPM interpole #8099644

AC GENERATOR

219 KVA G.E. TRE 2400/480/240 v. 3 ph. 60 cy. 200 RPM with exc.

200 KVA G.E. Type ATB 2200/440/220, 720 RPM, 3 brg.

AIR COMPRESSORS

846 cu. ft. 65# Ing. Rand 2 stage ERI
550 cu. ft. 100# Bury 2 stage
160 cu. ft. Chic. Pneu. 100#
67 cu. ft. Ing. Rand ER 1 100#

SHOP HOISTS.

2-Ton Sprague 230 v. DC Hoist.
1—½ Ton Box Lift AC

5—75 HP 230 v. Generator Electric Type 211 series wound with interpoles 550 RPM.

8—500 HP Type CS 2200 v. 3 ph. 60 cy. 500 RPM Westinghouse 3 brg.
5—350 HP Same as above.
3—300 HP same as above.

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Chicago Pneumatic simplate-valve Type NS03 straight line 16½" & 11" x 18" cap. 492 cu. ft. 100# pres. with air receiver and starting air compressor.

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Wanted Gas. 50-100 KW 480 V 3 Ph Sets

Lot 30" Cl fittings and 60" Valve

500 KW. Non Cond. Turbo, 2400 V. 3 Ph.
1500 CFM. 2 Stage Comp. Syn. Motor Dr.
4 Pumps 4166 GPM. 162' Hd. 250 HP Mtrs.
2—375 HP. B&W Boilers 200# ASME
6 HOT METAL LADLES, 120 TON
3—100 KW 125-250V DC Non Cond. Turbos

1800 HP. RED. GEAR 7.7 TO 1.0

12,000 SQ. FT. SUR. COND.

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MOTOR GENERATOR SETS, 3 phase, 60 cycle, A.C.

250 KW G.E. Rotary 275 Volt D.C. 2300 Volt A.C.
100 KW West. Rotary 275 Volt D.C. 2300 Volt A.C.
2—75 KW West. M.G. Set 250 V. D.C. 440 V. A.C.
50 KW Allis-Chalmers 250 V. D.C. 2200 V. A.C.

SYNCHRONOUS MOTORS 3 phase, 60 cycle

2—G.E. 700 HP 720 RPM 6600/4000/2300 Volt
Burke 300 HP 900 RPM 440/220 Volt
Ridgway 150 HP 1200 RPM 2300/440 Volt
C.W. 100 HP 900 RPM 440/220 Volt
Fairbanks-Morse 75 HP 720 RPM 220 Volt
G.E. 60 HP 720 RPM 440/220 Volt

SLIP RING MOTORS 3 phase 60 cycle

G.E. 60 HP 720 RPM 440/220 Volt
Allis-Chalm. 250 HP 600 RPM 440/220 Volt

ADJUSTABLE SPEED 220 Volt D.C. Motors

1—West. SK-201 150 HP 350/900 RPM
1—G.E. RF-18 90/120 HP 400/1200 RPM
1—G.E. RF-17 50/100 HP 450/1200 RPM
1—Reliance 1400-T 100/125 HP 300/900 RPM
1—West. SK-180, 100 HP 600/950 RPM
1—West. SK-180 45/90 HP 475/950 RPM
1—Diehl 50 HP 400/1200 RPM
1—Reliance 1400-T 50 HP 175/700 RPM
1—Reliance 461-T 50 HP 600/1400 RPM
2—Crocker-Wheeler 125-H 50 HP 175/700 RPM
1—Allis-Chalm. 35/70 HP 450/1350 RPM
1—Allis-Chalm. 25 HP 600/1800 RPM
2—West. SK-123 5 HP 300/1200 RPM enclosed

The Electric Motor & Repair Co., Cuyahoga Falls, O.

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1—INTERNATIONAL PD-40 Power Unit
60 H.P. F & M 3/60/2300—F & M Gen.
80 H.P. ATLAS—Belted
132 H.P. FULTON—D/C to West. 100 Kva. Gen.
2—55 H.P. BRUCE MacBETH NAT. Gas Engines
240 H.P. F & M 3/60/2300—F & M Gen.
2—300 H.P. F & M 3/60/2300—F & M Gen.
1—300 H.P. F & M 3/60/2300—F & M Gen.

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80 H.P. BALL 53 K.W. 125/250 Volt 3 Wire Westinghouse Generator
95 H.P. AMES-Unaflow
125 H.P. SKINNER—Center Crank
300 H.P. RIDGWAY 4 Valve 250 KVA 3/60/2300 Ridgway Generator

SPECIALS: 3 175 h.p. 150 rpm Westinghouse Syn. Motors

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Complete Diesel Plant

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Two 87½ h.p. Buda Engines
Two 55 k.w. Motor Generators
Philco Storage Batteries

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ALTERNATOR (Ideal) Fly Wheel type 125 K.V.A. 100 K.W. 60 cycle 3 phase, 220 volt, 360 R.P.M. with belted exciter.
GENERATOR engine type (Ideal) D.C. 50 K.W. 250 volt 360 R.P.M.
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Stokers—Stacks—Pumps and Heaters

2—150 HP HRT 125 lb. pressure all accessories
1—200 HP HRT 150 lbs. pressure all accessories
1—295 HP WT 180 lbs. pressure all accessories
3—300 HP WT 200 lbs. pressure, type "E" stokers
2—500 HP WT 180 lbs. pressure, Chain grate stokers

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35 K.W. 3 phase—60 cycle 220/440 V. to 115 V. D.C.—G.E.
16 K.W. 3 phase—60 cycle 220/440 V. to 115 V. D.C.—Hertner.
15 K.W. 3 phase—60 cycle 220/440 V. to 115 V. D.C. West.

WM. H. LUDWIG

656 Bushwick Avenue Brooklyn, N. Y.

SEARCHLIGHT SECTION

SLIP RING MOTORS, 3 PH., 60-CY.

HP	Volts	Make	Speed
500	2300	Whse.	450
350	2200	G.E.	600
300	2300–4000	G.E.	1200
250	440–550	G.E.	600
200	2200–550	G.E.	1800
200	2200–440	G.E.	600
150	440–220	G.E.	1800
150	2200	G.E.	900
150	2200–440	Whse.	1800
150	550–2200	G.E.	1800
100	550–2200	G.E.	720
100	220–440	G.E.	720
100	440–220	G.E.	600
100	220–440	G.E.	900
80	220–440	G.E.-MTC	900
75	440–220	G.E.	900
75	220–440	G.E.	600

SYNCHRONOUS MOTORS, 3-PH., 60-CY.

400	440–220	Whse.	276
350	440–220	G.E.	200
250	2300	G.E.	900
240	2300–440–220	G.E.	600
200	2300–4000	G.E.	1200
150	2200	G.E.	1800
100	440–220	G.E.	1200
50	220–440	G.E.	1200

TRANSFORMERS—60 CYCLE

3—400 kva., G.E. type H, 13800-440.
3—250 kva., G.E. type H-KD 23000-2300.
3—200 kva., G.E. H-KD 6600-2300/4000Y., 25 cy.
1—100 kva., Pittsburgh, type OISC 2400-240-120.
3—200 kva., G.E., type H-KD, 13800-230/460.
2—150 kva., Whse. 4800/4156/2400-480/240.
3—100 kva., G.E. type H, 2300-230/115.
3—100 kva., Whse type, SK, 2300-230/115
3—100 kva., G.E., type H-KDD, 6900/11950Y-230/115.
3— 75 kva., G.E., type HK, 2300-230/115.
3— 50 kva., Pittsburgh, 13800-240/120.
3— 50 kva., Moloney, 2300-230/115.
6— 50 kva., Whse type SK, 13800-240/120.
3—37½ kva., G.E., type H-K 2200-460.
3—37½ kva., G.E., type H-K, 2300-230/115.
3— 25 kva., G.E., type H-K 2300-230/460.
3—25 kva., Whse type S 2300-575
3— 25 kva., G.E., type H-KR, 6900-230/460.

A. C. GENERATORS

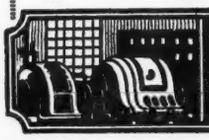
1—500 KVA. 900 r.p.m. 2200 V. Whse. Condenser.
1—312 kva., 900 r.p.m., 2300-V., Westghse.
1—300 kva., 600 r.p.m., 240-480-V., G.E.
1—225 kva., 600 r.p.m., 2200-240-480-V., G.E.
1—219 KVA. 200 r.p m., 480 V. Whse.
1—187 kva., 900 r.p.m., 2300-550-V., Westghse.

SQUIRREL CAGE MOTORS

HP	Volts	Make	Type	Speed
500	440/220	G.E.	IK	1200
500	440/220	G.E.	IK	900
400	2200	Whse.	C.S.	1800
300	2300/440	G.E.	IE-K	1200
250	2200	G.E.	IE-K	1800
250	2200	G.E.	I-K	600
200	220/440	G.E.	IK	720
200	2200	G.E.	IK	720
150	2200	Allis Ch.	AN	450
100	2200	G.E.	IK	600
100	2200	G.E.	IE-K	1800
100	550	G.E.	KT	900
100	220/440	G.E.	KT	720
75	2200	G.E.	KT	900
75	2300	G.E.	IE-K	1800
50	220/440	G.E	K	1800

MOTOR GENERATORS SETS

1—100 K.W., 250 V., 1200 R.P.M. Ridgeway, con. to 150 H.P., 2200 V., 3 ph., 60 cy., syn. motor.
1—60 K.W., 125 V., 1200 R.P.M. GE, type RC to 90 H.P., 4150/2300 V., 3 ph., 60 cy. syn.
1—25 K.W., 125 V., 1800 R.P.M., G.E., con. to KT 40 H.P., 2200/440 V., 3 ph., 60 cy. motor
1—GE, 3 unit set, consisting of 1 type RC, 10 KW, 250 V., 1750 RPM, and 1 RC, 10 KW, 125 V. Generators, coupled to KT, 35 H.P., 220/440 V., 3 ph., 60 cy., SC motor.



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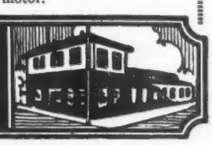

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TURBO-GENERATORS

1—3000 KW. GE. 600 V. Cond.
1—2500 KW. G.E. 2300 V. Cond.
1— 625 KW Terry-Allis—600 V. Cond.
1— 500 KW. G.E. 2300 V. Mixed P.
1— 500 KW. G.E. 600 V. Cond.
1—175 H.P. G.E. Turbine—only.

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1—2700 Cu. Ft.—IR—2300 V. Syn. Motor.
1—5588 Cu. Ft.—IR—Steam Driven. Cond.
1—1730 Cu. Ft.—Chic. Direct motor drive.
1—782 Cu. Ft.—IR—55#.
1—888 Cu. Ft.—IR—2 stage Steam.
1—599 Cu. Ft.—IR—2 stage Belted
2—549 Cu. Ft.—IR—Duplex 35# pressure.
1—173 Cu. Ft.—IR—ERI Belted.
1—146 Cu. Ft.—IR—3 stage Belted 2000#

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Type WM—675—8800/10800.
Volume—8800/10800 Pressure 32/39.6.
Driven by 820 H.P. G.E. Turbine.
Condition excellent.

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5—350 H.P. B&W 200#
2—500 H.P. Heine—250#
1—340 H.P. B&W Sterling—150#
2—160 H.P. B&W Sterling—155#
1—167 H.P. HRT—150#
1— 60 H.P. HRT—125#

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1—240 KW. 2300 V. connected to 360 H.P. Type Z wheel 13-15 Hd.
1—312 KVA. 2400 V. connected to Rodney Hunt wheel 17' Hd.
1—625 KVA. Morgan Smith 42' Hd.

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1—500 KW. G.E. 550 V. 225—RPM.

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1—4000 GPM, DeLaval Cent. 195 Ft. Head Driven by 300 H.P. G.E., 2200 V. motor
1—1500 GPM, DeLaval Cent. 290 Ft. Head Driven by 200 H.P. G.E., 2200 V. motor
1—1500 GPM, Gould Fire Pump, 231 Ft. Head Driven by 150 H.P. G.E., 2200 V. motor
2—1200 GPM, Worth. Cent., 180 Ft. Head Driven by 75 H.P. G.E., 2300 V. motor
1— 750 GPM, Worth. Fire Pump, 16x9x12 Steam Driven.

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1—200 KW **Westg. Syn. Motor Generator Set,** 600 V. D.C., Gen., connected to 290 H.P. Synch. motor 3/60/2200 and 900 RPM, with exciters and controls

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5—50 H.P. **G.E. Unused Slip Ring Type MTC Hoist and Crane Motors,** 600 RPM, 3/60/440.

5—50 H.P. NEW **Allen-Bradley Reversing Type Controllers,** self-contained, 3/60/440 V.

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SPECIALS: [**1—5000 KW & 1—2000 KW Turbo-Generators.**
1—1500 KW Turbo-Generator Non-Condensing.

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DIESEL ENGINE

450 H.P. Bessemer Solid injection Full Diesel Engine, 225 R.P.M., 4 Cylinder, 4 Cycle, 15" Bore x 22" Stroke, Tex Rope Drive to 300 K.W. G.E. Generator, 3 Phase, 60 Cycle, 2300 volt with Switchboard and G.E. Tyrell Voltage Regulator.

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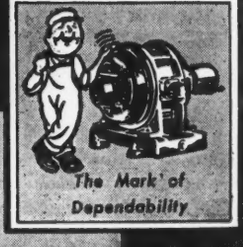

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3—380 HP **Heine boilers**, 180# pressure.
3—512 HP **Stirling**, Class S-26 200# pressure.
1—451 HP, 160# pressure, **B.&W. sectional header.**
1—600 HP **B&W boilers**, 200# pres.
1—250 HP, **Conley Stirling Type**, 200# pressure.
1—250 HP, **Erie City Economic** 150 lb. pressure.
2—500 HP **Edgemoor**, 200# pressure.
3—715 HP **Stirling boilers**, 225# pressure.

2—315 HP **Heine**, 175# pressure.
1—2000 HP **Cochrane metering feed water heater.**
2—625 KVA **General Electric turbines**, surface condensers.
2—500 HP **Stirling**, 160# pressure Underfeed Stokers
1—2000 KW **Westinghouse condensing turbine**, complete.
2—1250 KVA **Ridgeway Condensing Turbines.**
2—125 KVA **Skinner** (counterflow) **Eng. Gen. sets.**
1—250 KVA **Erie Ball Corliss** engine generator.
2—312 KVA **Skinner uniflow engine.**

1—180 KVA **Ames uniflow engine generator set.**
1—250 KVA **Fairbanks Morse full Diesel engine.**
1—300 KVA **Fairbanks Morse VA full diesel engine generator sets.**
1—450 KVA **Chuse Corliss engine generator set.**
1—2500 KVA **Nordberg uniflow engine generator set.**
5—180 HP **Fairbanks-Morse** Model 35, Oil Engines, new in 1935.
1—84" x 125' self-supporting steel stack.
1—3500 HP **Swartwort open feedwater heater.**

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150 KVA G. E. Gen. Dir Con Ex. 325 RPM, Coupled to 3 cyl Worthington Full Diesel A-1.

125 KVA G. E. Gen Dir Con Ex. 720 RPM, Coupled to 6 cyl Gasolene or Nat Gas Engine, Like New.

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1—140' long by 84' wide with full length lean-to 26' wide; 72' span crane runway in main section 120' long.
1—67' x 61'—Both fabricated steel construction, bolted together, with Johns-Manville Transite corrugated asbestos roofing and siding.
Excellent Condition

DERRICK & PULL HOISTS

16—Electric and air driven, single and double drum.

For immediate delivery

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BOILERS

2—300 H.P., 180# 3 drum, low head, bent tube, pulverizers. Water walls. Complete plant.
2—400 H.P., 250 #, 3 drum, bent tube, side dump stokers.
2—400 H.P., 160#, 4 drum, bent tube, pulverizers.
1—350 H.P., 180#, cross drum, box header, stoker.
1—450 H.P., 250#, bent tube, under feed stoker.
Sectional header boilers, (2) 450 H.P., (1) 300 H.P., (1) 175 H.P., 200% rating, (2) battery, suspended, 129 H.P. (each) 150#, HRT boilers with stokers.
B&W Superheater, (used 9 months) suitable 500 H.P. boiler—100 degree.
1—167.5 H.P. HRT., 152# with stoker.

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250 KW Non Cond., Bleeder, 240 v., AC. 400#
Diesel Plants { 500 HP, in 2 units 3/60/220 v. / 900 HP, in 2 units 400 r.p.m.
4—50 HP Complete Diesel Installation

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1—Air Compressor, Worthington Pump & Machine, steam driven, size 12x30x15x14, 1330 cu. ft. per minute, 235 R.P.M., 50-lb. maximum pressure, 120-lb. steam pressure. No. L26581.
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1— 110 HP NEW G.M. Diesel
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Pulverizers, Pumps, Feed Water Heaters, etc.

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Several hundred 550 volt, 3 ph., 60 cycle AC motors.
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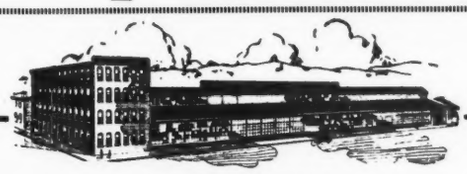

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220 V. 3 Ph., 60 Cycle

1—40 HP, 1200 RPM, Type 19TRN
2—100 HP, 1200 RPM, Type 26V

440 V. 3 Ph. 60 Cycle

1—7½ HP, 1200 RPM, Type 13TRN
1—50 HP, 600 RPM, Type 26TRN
1—50 HP, 1200 RPM, Type 19VRN
1—125 HP, 720 RPM, Type 31V
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1—125 KW, 125 volt, 250 RPM, Westinghouse Generator connected to a 15" x 16" Skinner Automatic Engine.

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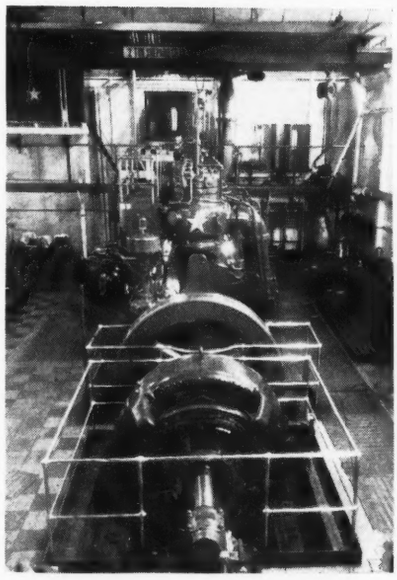

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1—300 HP **Allis Chalmers**, 3 PH, 25 CY, 440 V, 485 RPM slip ring.

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1—200 HP **Westinghouse** syn. 1 PF, 3 PH, 60 CY, 2200 V 600 RPM with direct connected exciter, 3 or 2 bearing.

2—150 HP **Allis Chalmers**, 3 PH, 60 CY, 440 V, 450 RPM slip ring.

2—150 HP **Westinghouse**, type CW, frame 1000, 2 PH, 60 CY, 440 V, 450 RPM slip ring.

2—100 HP **Westinghouse**, type CS, frame 754 C, 3 PH, 60 CY, 440 V, 870 RPM sq. cage.

3—150 HP **Allis Chalmers**, 3 PH, 60 CY, 440 V, 1750 RPM sq. cage.

1—100 HP **Westinghouse**, type CCL, 3 PH, 60 CY, 2200 V, 1750 RPM sq. cage.

1—100 HP **Wagner**, type 26V5BP, 3 PH, 60 CY, 440 V, 860 RPM sq. cage

2—100 HP **Allis Chalmers**, type ANY, 3 PH, 60 CY, 440 V, 690 RPM slip ring.

1—100 HP **Westinghouse**, type SK, frame 160, 230 V, 1100 RPM.

1—100 HP **Allis Chalmers**, type ANY, 3 PH, 60 CY, 2200 V, 690 RPM slip ring.

1—75 HP **Allis Chalmers**, 3 PH, 60 CY, 440 V, 450 RPM slip ring.

1—75 HP **Westinghouse**, type CW, 3 PH, 60 CY, 440 V, 720 RPM slip ring, 3 or 2 bearing.

1—75 HP **Fairbanks Morse**, type H, frame 165 C, 3 PH, 60 CY, 550 V, 900 RPM sq. cage.

2—75 HP, **General Electric**, type I, 3 PH, 60 CY, 220 V, 720 RPM sq. cage.

1—75 HP, **General Electric**, type MT, frame 337, 220 V, 3-60-1745 RPM.

1—75 HP **Lincoln**, type IQ, 2 PH, 60 CY, 440 V, 600 RPM sq. cage.

1—75 HP **Finn-Weiksel (Wagner)** ty. 26VRN, 3 PH, 60 CY, 220 V, 1200 RPM syn.

1—250 HP **Crocker Wheeler**, type CCM, size 151 H, 230 V, 600 RPM, DC

3—100 HP **General Electric**, type CD, frame 123, 230 V, 1200 RPM DC

1—60 HP **General Electric**, type CD, frame 115, 230 V, 850 RPM, DC

1—50 HP **Westinghouse**, type SK, frame 160, 230 V, DC, 565 RPM

1—50 HP **General Electric**, Class 6, Form B, 600 V, DC, 600 RPM

1—50 HP **Ideal**, type SMS, 3 PH, 60 CY, 220 V, 1800 RPM, synchronous.

1—60 HP **Westinghouse**, type SK, frame 160, 230 V, DC, 680 RPM

1—60 HP **C&C**, 230 V, DC, 250/1000 RPM

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3—75 HP **Westinghouse**, type SK, frame 150, 230 V, DC, 1100 RPM

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1—60 KW **General Electric**, type DLC, 150 V, DC, 220 V, AC M-G set

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Est. 1903

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40—Various sizes cast iron radiators

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Both in good running order.

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26 pounds (air)
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33—16½" B&W Steam Atomizing **GAS AND OIL BURNERS, GAS REGULATORS, FUEL OIL HEATERS,** and Miscellaneous Accessory Equipment.

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COCHRANE DEAERATING HEATER
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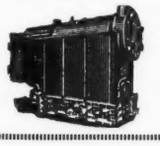

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Preferably 1,300 HP, 75' head, 6,600 volts, 3-phase, 50-cycle. Will consider offers of any part and anything over 400 HP, or with other characteristics.

W-268, Power

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GIVE EVERY VALVE IN YOUR PLANT A NEW LEASE ON LIFE . . . . . KEEP GOING WITH PRESENT EQUIPMENT !

. . . that's what DEXTER VALVE RESEATING EQUIPMENT will do for YOU!

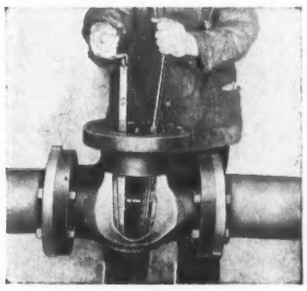
Make your Globe, Gate and Pump Valves last longer—NOW!

Dexter Valve Reseating Equipment makes savings all along the line which when added up mean more power, lower, faster maintenance and insurance against shut down.

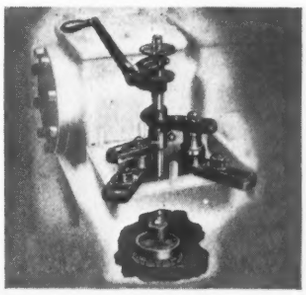
Now is the time to stop leakage losses and keep your plant in continuous operation—*Now* when you're waging a war against waste and applying every measure to meet increased power demands. Now is the time to make your valves leak-proof the Dexter way—the sure, low cost, convenient way to make your valves last longer.

Every type of valve—Globe, Gate and Pump—can be properly reseated and reconditioned with Dexter Equipment. Availability of Dexter Equipment for prompt shipment means that you don't have to wait for valve parts to put your valves in perfect condition.

Dexter Globe Valve Reseating Machine



Dexter Gate Valve Reseating Machine



Dexter Pump Valve Reseating Outfit

VALUABLE TIPS ON VALVE CARE

Inspect valves regularly.

Reseat, Regrind valves as soon as they leak with Dexter Equipment

Don't force improperly seated valves—Reseat them the Dexter way.

Clean valves and pipe lines before installing valves; Keep valves closed during installation.

Cut pipe threads to proper length; use compound or pipe not in valve.

Do not use bars or wrenches for opening and closing valves—use hand wheel.

Open and close valves slowly.

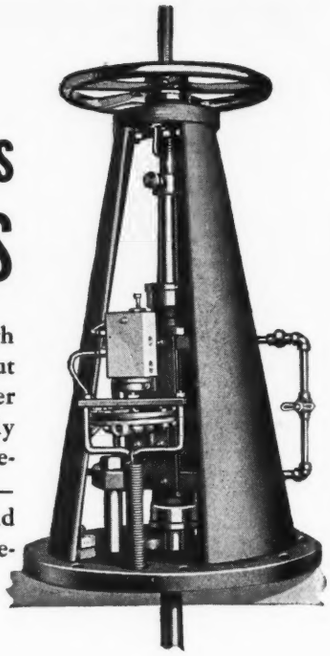
The 32-Page Dexter Catalog contains specific, helpful information on valve maintenance—sent Free on request.

THE 32-PAGE DEXTER CATALOG Contains Specific, Helpful Information On Valve Maintenance.

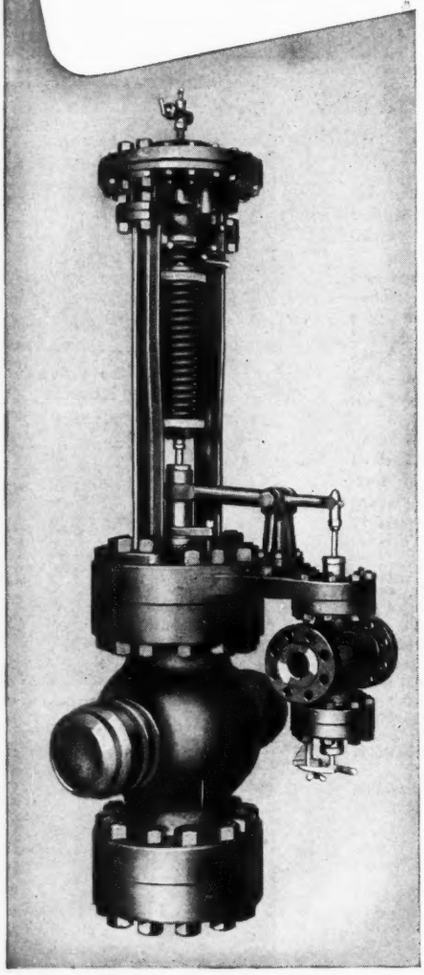
Sent FREE on Request

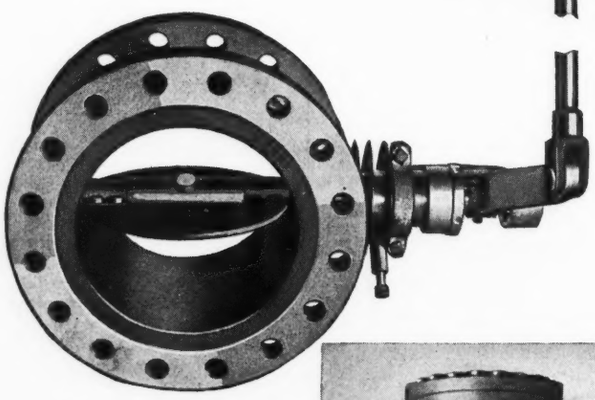
The LEAVITT MACHINE CO. ORANGE, MASS.

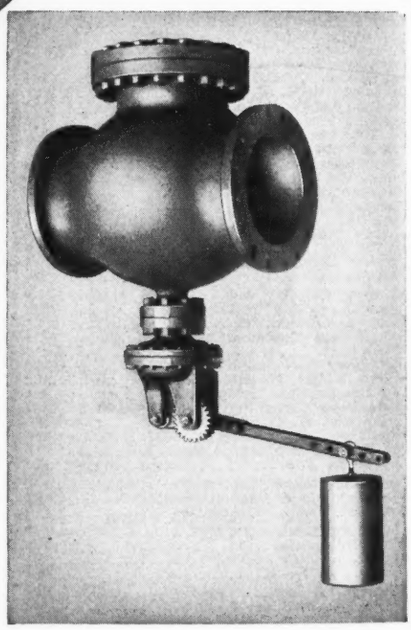
Solve Unusual Pressure Control Problems with SWARTWOUT SPECIAL CONTROLS



IF you've ever had, or are likely to have a pressure control job for which there is no standard valve or control, it pays you to know that Swartwout supplies safe positive-action equipment to fit your needs with least bother and expense • Special Valves, such as a few shown here, are carefully engineered to meet the need. Standard basic parts and mechanisms, with special features where required, are combined to achieve unfailing efficiency—at a reasonable cost. Thirty-six years experience in applying Swartwout and "S-C" valve principles in thousands of installations, guarantees you completely satisfactory performance. . . . Tell us your problem, now.







ABOVE. 12" Butterfly Valve with operating cylinder and manual control stand. The operating cylinder is equipped with a "positioner" which assures identical positions of the butterfly valve for each operating condition. Butterfly Valve built to withstand high pressure and high temperature operating conditions. Weirton Steel Company.

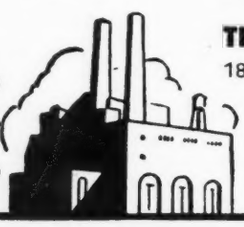
LEFT. A 6" 1500 lb. Std. Pressure Reducing Valve with auxiliary water admission valve controlling supply of water to desuperheater. When the reducing valve cuts in, water supply is also automatically cut in, in accordance with the flow. Columbus & Southern Ohio Electric Company.

RIGHT. A 16", self contained Control Valve operating at pressures from vacuum to 37 lb. The valve is wide open until pressure on the discharge side reaches 37 lb., at which point it accurately maintains this pressure. Union Electric Light & Power Company.

Feed Water Regulators • Pump Governors • Feed Water Heaters
Master Controls • Reducing Valves • Separators • Exhaust Heads

Swartwout

•Power Plant Equipment•



THE SWARTWOUT COMPANY
18541 Euclid Avenue • Cleveland, Ohio

* * *

Controlled **AIR CIRCULATION**
for Power Plants and Industrial Buildings

HOW TO FI

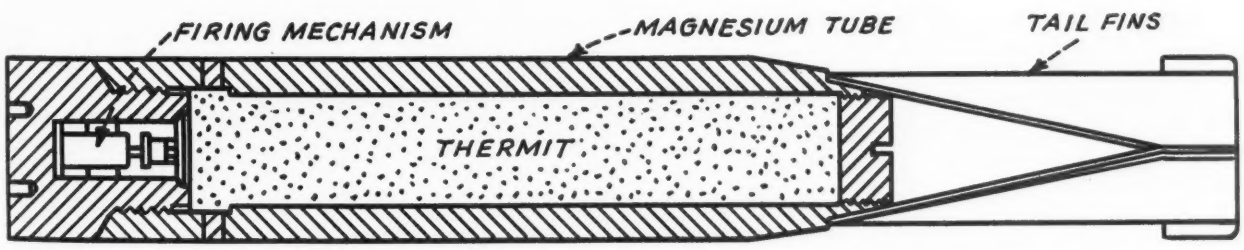
HOW INCENDIARIES BURN

Waging a successful fight on incendiaries depends on knowing how the bombs behave. The most common incendiary consists of a thick-walled magnesium tube (9 in. long, 2 in. dia) filled with thermit. The "business" end carries a firing mechanism; a magnesium cap covers the other end.

The sheet-iron tail makes the bomb hit on the firing pin. Incendiaries fall in a curved trajectory and it is entirely possible for them to enter windows and through light side walls. This means that you must be prepared to fight bombs inside the plant as well as on the roof.

The first pictures (right) show the two-stage burning process. Immediately after the bomb hits, the thermit burns with intense heat (over 4500 F). The magnesium then burns for 15 minutes, if not disturbed. About one bomb in 50 carries an explosive charge which goes off during the first two minutes. Study pictures of bomb action carefully—this is the key to successful handling.

Approved fire extinguishers, standpipes and sprinklers — standard equipment in industrial plants — actually offer the best protection against incendiaries. Pictures in two lower rows show approved methods of fighting bombs, using water sprays and sand. Any of these methods, intelligently applied, will do the job. Choose methods that fit your conditions.

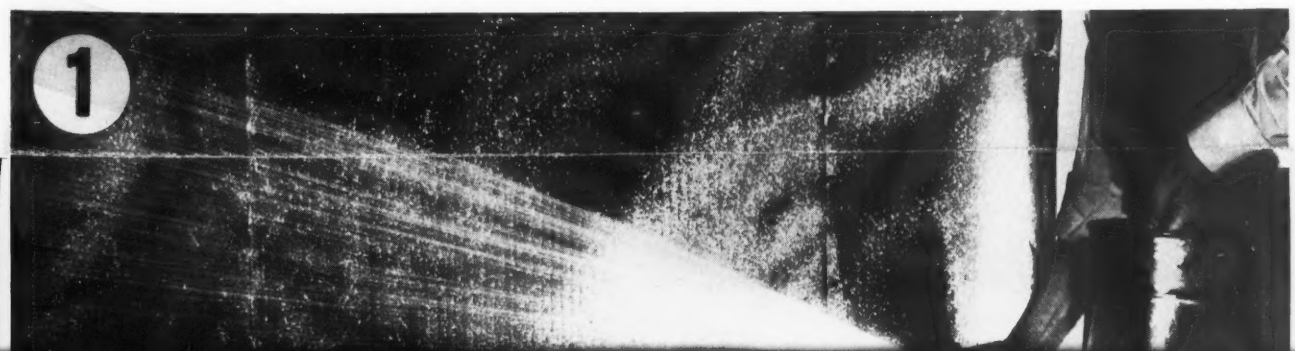


As thermit burns (about
ters fiercely and throws
Stay clear until end

HOW TO FIGHT INCENDIARIES WITH WATER

Water and foam sprays, from pump tanks, approved fire extinguishers, standpipes or sprinklers, control bombs effectively and offer the advantage of wetting down surrounding areas. Always thumb the nozzle to secure a spray

Do not use a solid stream
and quick generation of
flaming particles far



FIGHT THE

As thermit burns (about 1 min) bomb sputters fiercely and throws pieces 10-15 ft. Stay clear until end of thermit action

Magnesium burns with bright white flame; melted magnesium forms a pool around bomb. Start work on bomb as soon as it settles to steady burning

TH WATER SPRAYS

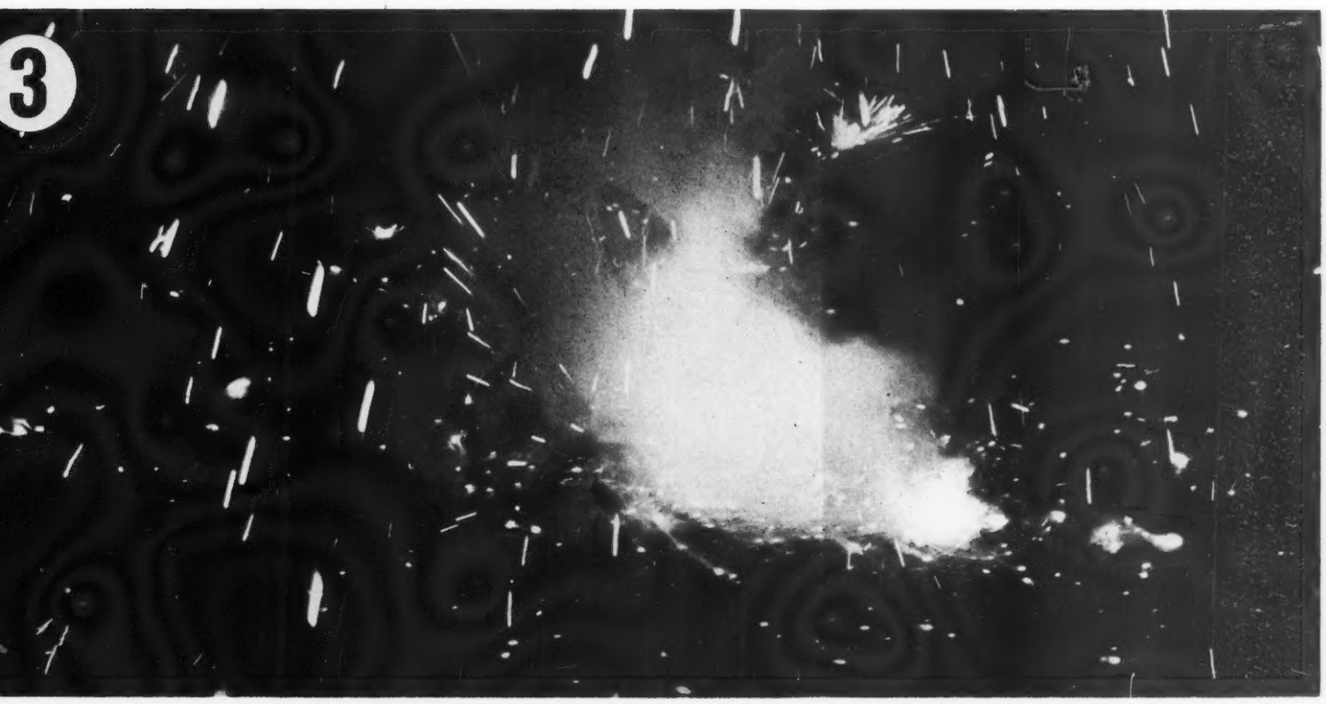
Do not use a solid stream on a bomb. It penetrates the bomb surface and quick generation of steam causes explosive bursts, scattering the flaming particles far and wide. Remember—always use a spray!

Remove and carry extinq
Soda-acid units discharge
start gas-cartridge units

E FIRE BOM

Approach bombs burning on concrete with extra caution. Intense heat vaporizes moisture in concrete; spurts of steam formed throw flaming fragments 15-30 ft, even during steady magnesium-burning stage

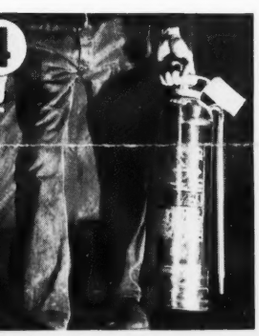
Scar on plank
Watch for
by fragment

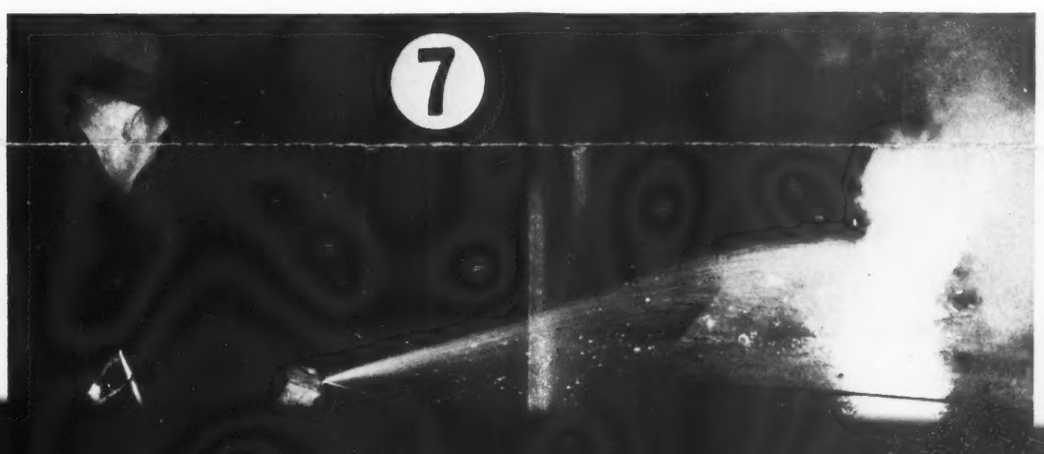


tinguisher as in 3, 4.
ge when inverted, 5; to
nits, bump head, 6

With either soda-acid or gas-cartridge extinguisher, thumb nozzle to produce water spray and direct at bomb. Don't start discharge until bomb can be attacked effectively

Pump tank
require on
pumps usu

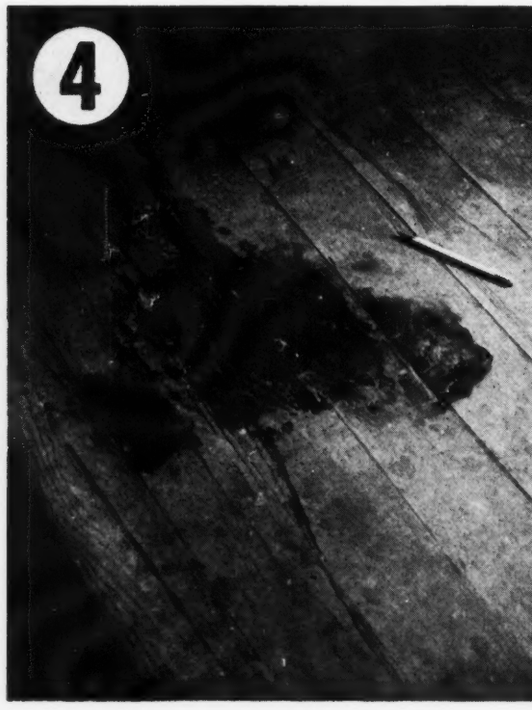




IRE BOMB

mbs burning on concrete with extra caution. Intense heat sture in concrete; spurts of steam formed throw flaming 5-30 ft, even during steady magnesium-burning stage

Scar on planking left by extinguished Watch for fires in surroundings s by fragments thrown by burning t



With either soda-acid or gas-cartridge extinguisher, thumb nozzle to produce water spray and direct at bomb. Don't start discharge until bomb can be attacked effectively

Pump tanks like that shown hold 5 require only one man for operatio pumps usually require more than one

REVIEWED AND PASSED BY OFFICE OF CIVILIAN DEFENSE

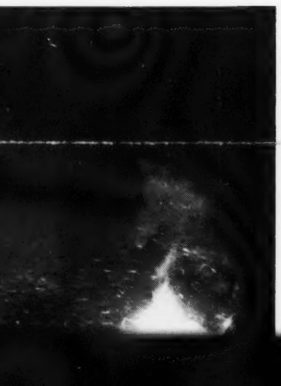
PICTURES TAKEN BY POWER'S PHOTOGRAPHER WITH THE COOPERATION OF THE SAFETY RESEARCH INSTITUTE, INC.

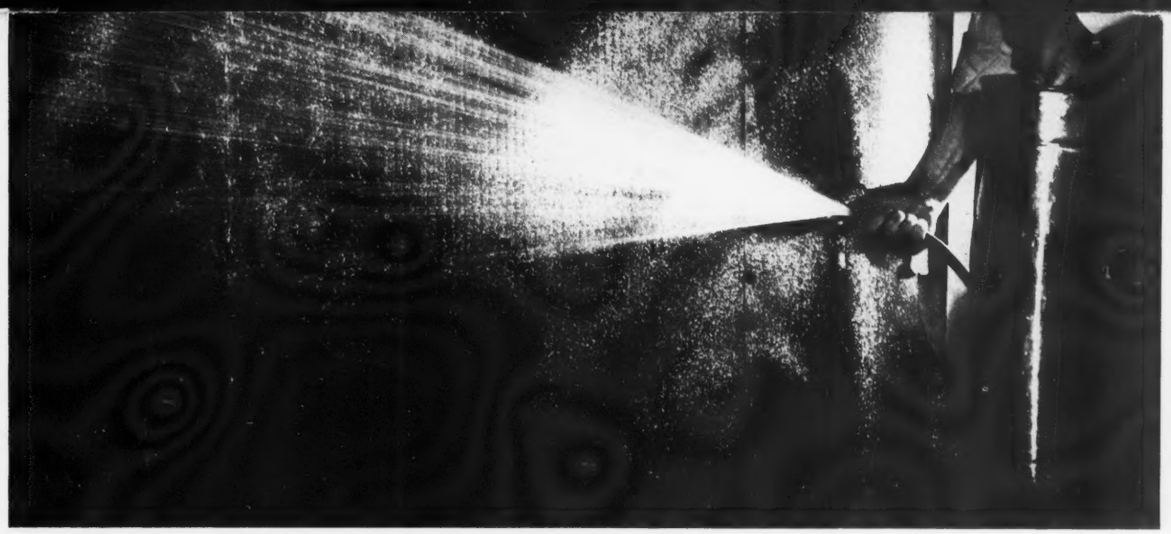
uished bomb.
dings started
rning thermit

Unless promptly attacked, bomb easily eats way through planking to continue burning in space below

hold 5 gal and
peration. Stirrup
han one operator

Foam extinguishers (95% water) can be used effectively. Direct spray to build up foam covering on bomb

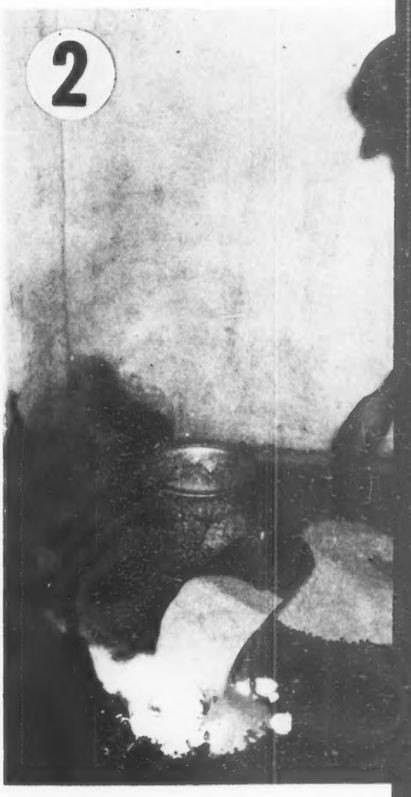




HOW TO FIGHT INCENDIARIES WITH SAND

Fighting with sand requires only simple equipment—shovels and buckets—but is only suited for use when the bomb falls on an incombustible surface and does not start a fire. After thermit burns out, dump half a bucket of sand as close to the bomb as possible

Shovel sand from th
on the bomb, cover
as completely as p



ITH SAND

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Shovel sand from the pile on the bomb, covering it as completely as possible

Covering bomb with sand does not extinguish it immediately. Silica reacts for a short time, causing "volcano" action pictured below

VOL. 86, NO. 5—MAY, 1942
IN TWO PARTS, PART TWO

P O W

When burning subsides, scoop up bomb and sand. Short-handled shovel can be used but longer handle makes it unnecessary to approach bomb closely. Asbestos gloves, and goggles, protect against flying fragments but are not necessary if caution is used

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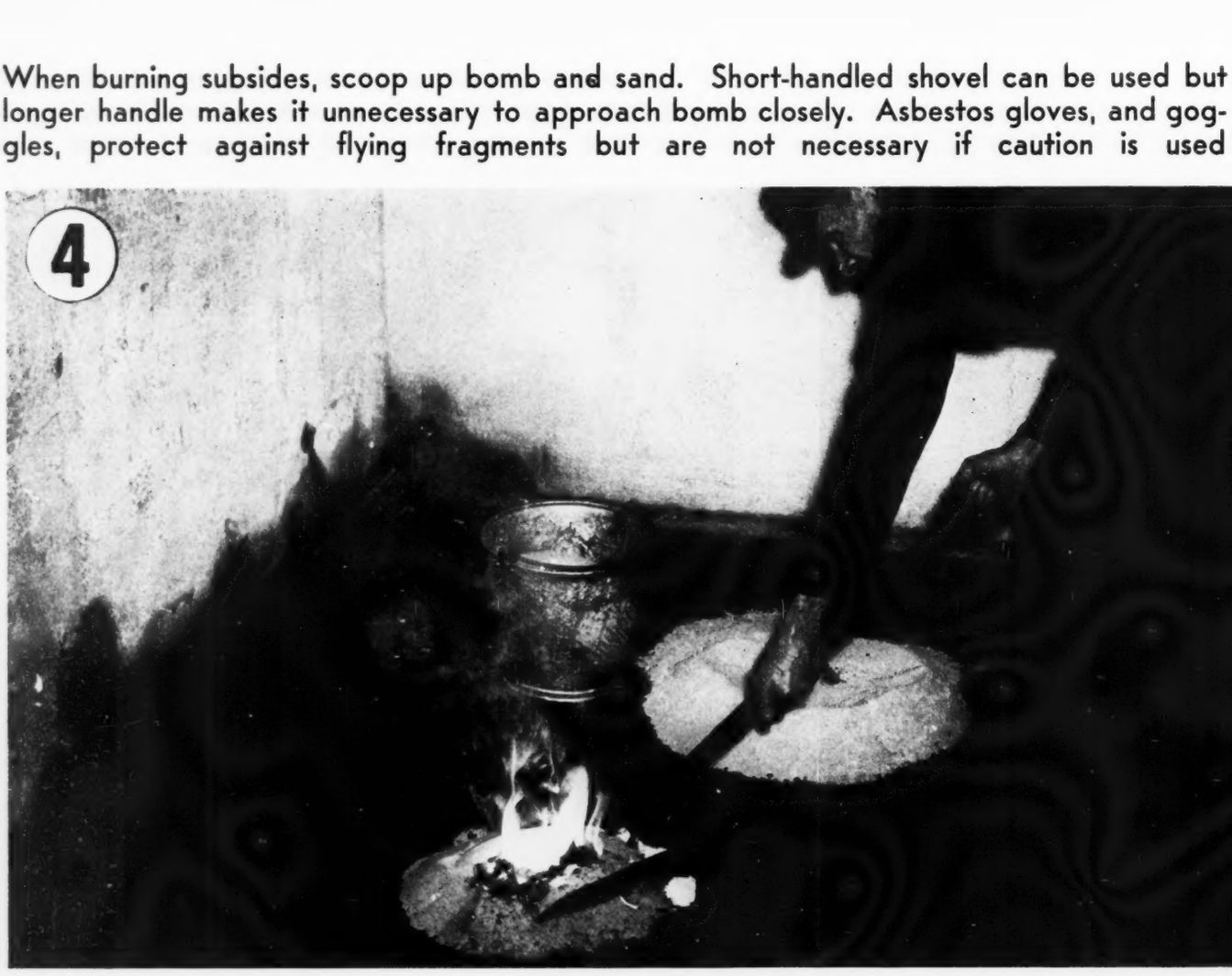

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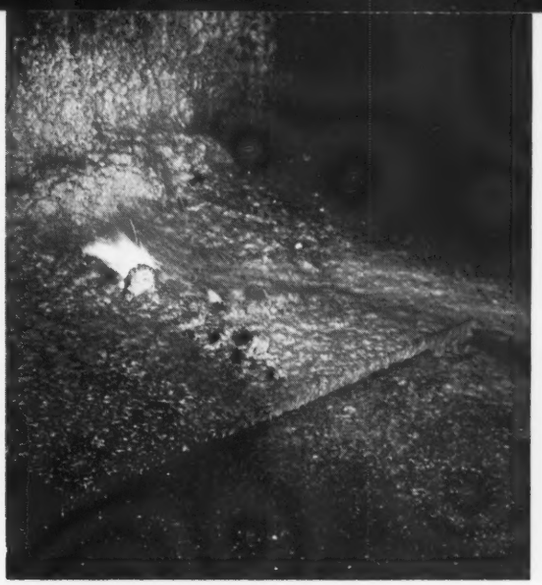

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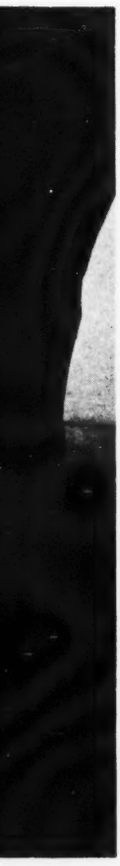
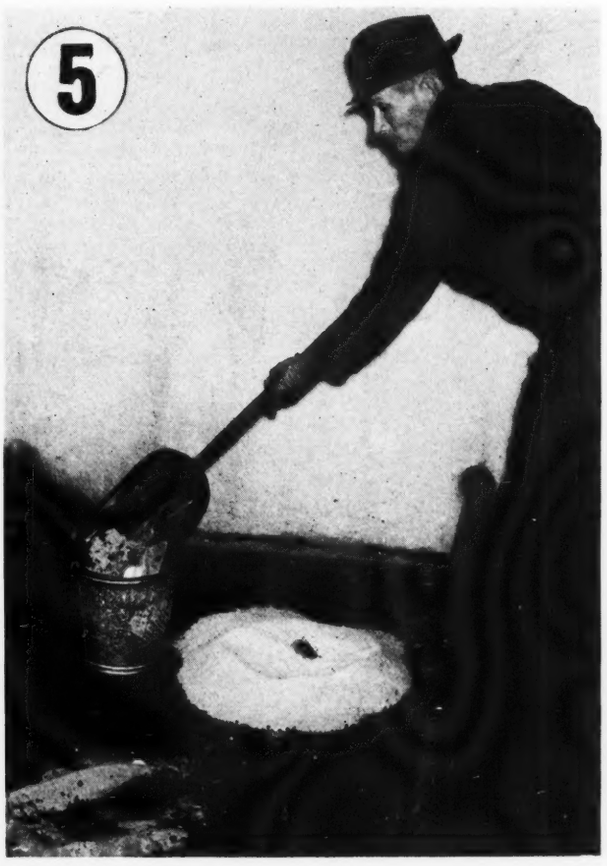
Dump bomb into bucket left filled with three or four inches of sand. Extra sand on top makes bomb relatively harmless

Bomb may be carried away in pail, or left if other bombs require action. Before leaving look for fires started by fragments





THE
Sprinkler Bulletin
No 169]
31st DECEMBER, 1941
[Published Quarterly
WAR TIME SPRINKLER RECORD
A critical analysis of two years under air raid conditions
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STATIC WATER AND AIR PRESSURE TANK PROVE THEIR WORTH Page 1047
60 Ft.
Fig. 1
SPRINKLERS EXTINGUISH EIGHT INCENDIARY BOMB FIRES—SEE STORY ON PAGE 1041.
77 Heads Opened. Fires marked ● Opened Sprinklers ○

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CONTENTS

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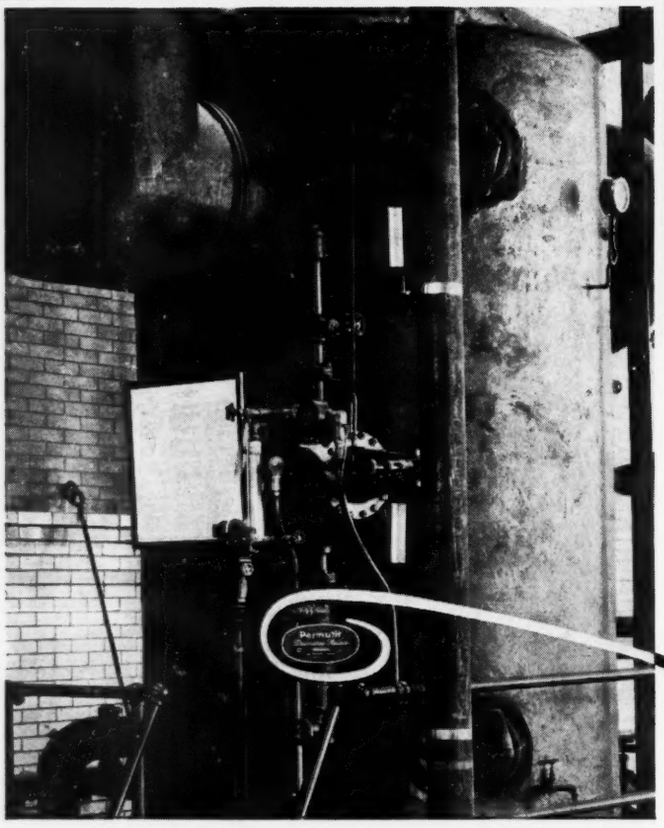

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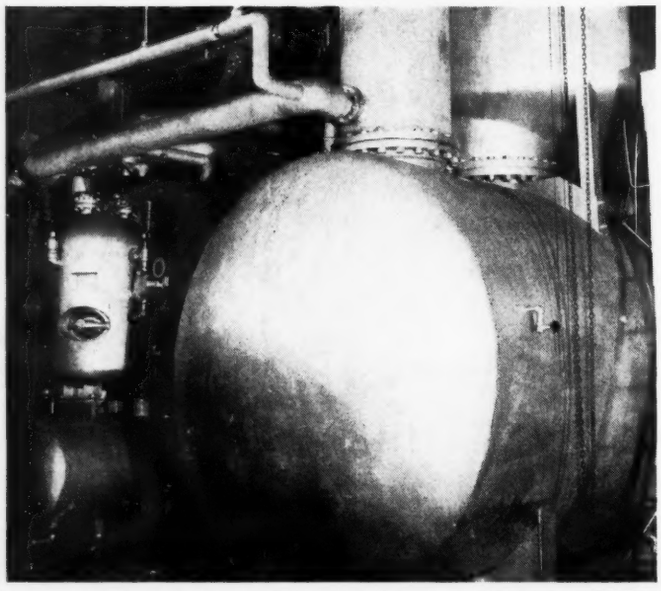

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